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Space Administration

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NASA SP-7037(156)

AERONAUTICAL ENGINEERING

**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

(Supplement 156)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in December 1982 in

- *Scientific and Technical Aerospace Reports (STAR)*
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Scientific and Technical Information Branch

1983

National Aeronautics and Space Administration

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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 288 reports, journal articles, and other documents originally announced in December 1982 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* and *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

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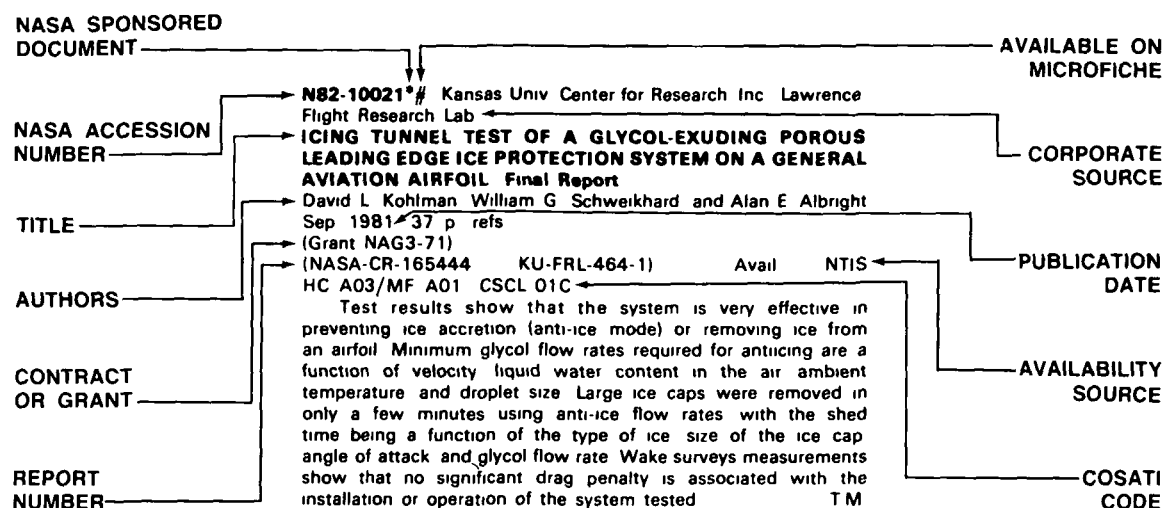
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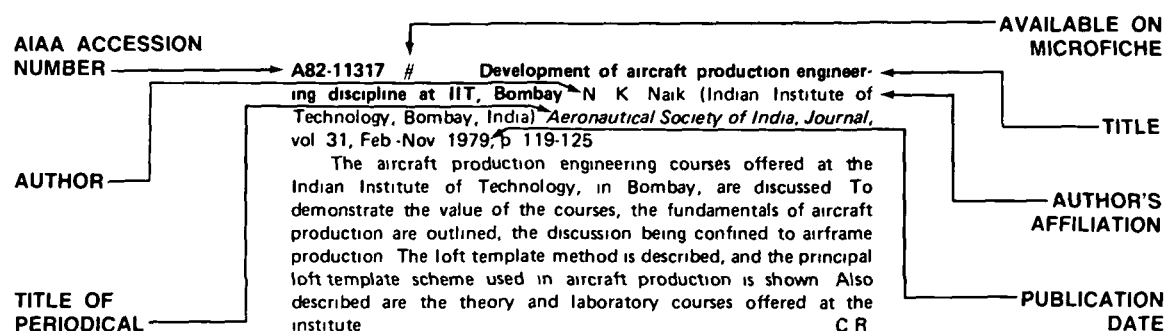
TABLE OF CONTENTS

	Page
IAA ENTRIES (A82-10000)	559
STAR ENTRIES (N82-10000)	567
Subject Index	A-1
Personal Author Index	B-1
Contract Number Index	C-1

TYPICAL CITATION AND ABSTRACT FROM STAR



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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 156)

JANUARY 1983

IAA ENTRIES

A82-44940 Phoenix airport solar photovoltaic concentrator project. C M Zittle (Motorola, Inc., Government Electronics Div., Scottsdale, AZ) In Photovoltaic Specialists Conference, 15th, Kissimmee, FL, May 12-15, 1981, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p 86-89

Plans for the construction of a 225 kW solar photovoltaic concentrator at the Phoenix, AZ airport are given. The basic concentrator module for the system uses a 24 inch square acrylic Fresnel lens, focusing energy on a 3-inch diameter, float zone silicon solar cell. Each cell has a peak output of 41.6 W at 1 kW/sq m insolation and 28 C. Modules will be mounted on eighteen 65 foot wide two-axis tracking turntables, and a dc-ac converter will be used for connecting the system to the utility grid. Preliminary tests of the first array indicate that 10 kW (normalized to 1 kW/sq m and 28 C) is produced, for a 2.5 kW loss. The present recurring cost of the system is \$15.96 per watt, but for the production of 400 arrays per year, the recurring cost would be \$6.90 per watt. A B

A82-45146 Use of DFVLR in-flight simulator HFB 320 Hansa for handling qualities investigations. H-H Lange and D Hanke (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugmechanik, Brunswick, West Germany). *Zeitschrift für Flugwissenschaften und Weltraumforschung*, vol 6, July-Aug 1982, p 225-234. 12 refs

The DFVLR-HFB 320 in-flight simulator is described, flight test results are reported, and some simulator applications are discussed. Simulation requirements are stated and the most important test equipment is discussed along with the control system model, gust simulation, and control system realization. Test results for step response, flight maneuvers, and in-flight simulation under gust conditions are shown. Possible applications of the system include direct lift control (DLC) handling qualities research, in-flight simulation of the A310 Airbus with DLC in the landing approach, and handling qualities investigation of a rate command/altitude hold system for future transport aircraft. C D

A82-45187 # A simplified method for predicting rotor blade airloads. S Wang and Z Xu (Nanjing Aeronautical Institute, Nanjing, People's Republic of China). *Acta Aeronautica et Astronautica Sinica*, vol 3, June 1982, p 1-17. 11 refs. In Chinese, with abstract in English

A simplified approach to the prediction of rotor blade airloads is presented. The relationships of the first two harmonic induced velocities to the lower and same-order harmonic circulations are obtained from the generalized classical vortex theory of the rotor. Then, based on the blade element theory, a closed form of equations for circulation is established and, by taking the flapping condition into account, simplified formulas for predicting rotor blade airload are set up. Expressions for flapping coefficients are derived, including the effect of variable induced velocity distribution, but in terms of blade parameters and flight parameters only. Finally, a calculation of a typical example is made and by comparing the calculated values with those from the more accurate numerical solution, it is shown that the present method is fairly suitable for aerodynamic analysis and preliminary design of helicopters. C D

A82-45188 # Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid. Z Li and T Ruan (Jiangxi Aeronautical Society, Jiangxi, People's Republic of China). *Acta Aeronautica et Astronautica Sinica*, vol 3, June 1982, p 18-28. 5 refs. In Chinese, with abstract in English

A calculation of pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid is presented for the case of continuous wake-surface and forward motion of a helicopter at a constant speed. An acceleration potential equation is derived and a fundamental solution of the pressure doublet in an arbitrary motion is given. In order to satisfy the wake condition it is assumed that the pressure doublets move along the wake surface instead of along the actual tracks of blades. By adding the moving pressure doublets, an integral equation of the three-dimensional unsteady compressible fluid with superior singularity is obtained when the blades are in complex motion. The significant effect of compressibility on the higher harmonic pressures is shown in this equation. The Hadamard principal value can be determined for part of the kernel

function of the integral equation. The higher harmonic pressures are calculated, and a simple typical example is worked out. C D

A82-45189 # Application of Kalman filtering technique to aerodynamic derivatives for a helicopter. S Yang (Flight Test Research Institute, People's Republic of China). *Acta Aeronautica et Astronautica Sinica*, vol 3, June 1982, p 29-35. In Chinese, with abstract in English

A method for extracting the aerodynamic derivatives of a helicopter from flight data by means of low pass filtering, Kalman filtering, and least squares technique is described. The high frequency effects from the rotor are eliminated by low pass filtering, and measurements of noise and process noise statistics are obtained. Random noise is minimized and bias error eliminated by using the Kalman filter, and the derivatives are identified from the raw data by the least squares technique. They serve as initial values for Kalman filtering, and the final derivatives are again extracted from Kalman filtering by the least squares technique. The method requires considerably less computation than the maximum likelihood method. It is more accurate than the least squares technique and the least squares technique with Kalman filtering, reducing error by more than 70 percent relative to those methods. C D

A82-45192 # An analogy method for crack initiation life prediction. F Zhang (Air Force Research Institute, People's Republic of China). *Acta Aeronautica et Astronautica Sinica*, vol 3, June 1982, p 51-60. In Chinese, with abstract in English

A method for crack initiation life prediction of components is presented which employs the life of a given component obtained from endurance tests under spectrum load to predict the life of another untested component of the same type by analogy. A formula for analogy life prediction is deduced from Miner's theory and the formula $S(m)N = C$, with values for the load cyclic number, stress amplitude, overload increment, and life cyclic number of the given component in level. With this formula it is unnecessary to choose the constant Q in Miner's formula, thus improving the accuracy. The lives of large components of two aircraft under five different loading conditions are predicted by this method. The results are consistent with fatigue test results. C D

A82-45213 † Control of the operations of a 'flight complex' (Upravlenie ekspluatatsiei letatel'nykh kompleksov). L I Volkov. Moscow, Izdatel'stvo Vysshaya Shkola, 1981. 368 p. 73 refs. In Russian

This book is concerned with the theory of the control of ground installations for flight vehicles. The term 'flight vehicle' (FV) is understood to include balloons, airships, aircraft, rockets, and, in general, vehicles travelling exclusively in the atmosphere as well as vehicles which pass through outer space. However, particular attention is given to the operation of pilotless, controlled vehicles with reaction engines. For the successful employment of the FV, it is necessary to provide ground installations having various types of equipment with the required personnel for maintenance operations, the launching of the FV, communication, and FV control objectives. Such installations represent large, complex systems, and the development of appropriate control procedures for cost-effective optimized operation is a major task of great importance. Approaches of system operation on the basis of an execution of suitable programs are considered, and aspects of a theory of system reliability are examined. The effectiveness of system operation is investigated, and attention is given to evaluation methods based on statistical procedures. G R

A82-45219 # Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method (Zur Berechnung des Stabilitäts- und Nachbeulverhaltens dünner Schalentragwerke nach der Methode der Endlichen Elemente). E Scheikle. Stuttgart, Universität, Fakultät für Luft- und Raumfahrtstechnik, Dr.-Ing. Dissertation, 1981. 179 p. 97 refs. In German

The geometrically nonlinear elastic stability problem and the determination of the post-buckling region in thin shell underframes are discussed. The basic characteristics of geometrically nonlinear elastostatics are explained and an introduction to the stability theory of elastomechanics is provided. The problem of elastostatic instability is clarified and solution methods are presented for determining critical loads for the breakdown and branching problems. For determining the start of the post-buckling region, an incremental eigenvalue analysis is presented which can be used to overcome the singular stiffness matrix problem that occurs there. To evaluate the unstable post-buckling region, an incremental

analysis is used which is based on a solution for incompletely defined matrices. The influence of imperfections on the stability behavior is also studied. The accuracy, effectiveness, and applicability of the algorithms and programs are shown with practical examples. C D

A82-45221 # The determination of the duration of an exposure to aircraft noise (Die Ermittlung der einwirkdauer von Luftfahrzeuggerauschen). P. Zeller. München, Technische Universität, Fakultät für Elektrotechnik, Dr.-Ing. Dissertation, 1981. 138 p. 68 refs. In German.

It has been found that between three to five million people in West Germany feel harassed by aircraft noise. A number of approaches are being considered to reduce the harmful effects of aircraft noise. The present investigation is concerned with the parameters required for an evaluation of the magnitude of aircraft noise effects, taking into account the maximum noise level and the duration of noise exposure. The dependence of these parameters on a number of influence factors is theoretically studied, and the results are compared with measured data. The obtained information is to provide a basis for a more accurate advance calculations of the boundary lines of constant noise stress. (Author)

A82-45222 # Numerical calculation of the flow in compressor and turbine cascades (Beitrag zur numerischen Stromungsberechnung in Verdichter- und Turbinengittern). M. von Allmen. Stuttgart, Universität, Fakultät Energietechnik, Dr.-Ing. Dissertation, 1981. 98 p. 60 refs. In German.

The design of the blading for a turbomachine on the basis of fluid flow considerations is briefly discussed. It is found to be most convenient if the designer can utilize as a basis for his development work a catalog containing profiles with known characteristics. Modern computer technology together with suitable numerical solution methods make it now possible to implement the indicated approach. The development of optimal cascade configurations requires the continuous improvement of the procedures for the solution of the computational problems by the designer. The present investigation provides a contribution to such an improvement. The considered solution procedure is concerned with a description of blade-to-blade flow in axial flow turbomachines, taking into account the subsonic region. A recently developed difference method is employed and possibilities provided by computer graphics are utilized. G R

A82-45346 Passive direction finding and signal location. A. R. Baron, K. P. Davis, and C. P. Hofmann (Litton Industries, Amecom Div., College Park, MD). *Microwave Journal*, vol. 25, Sept. 1982, p. 59, 60, 62 (8 ff).

Three types of passive location of stationary ground-based emitters from airborne platforms are examined with reference to the performance achieved with each of the approaches and applications to which they are best suited. The three approaches discussed are: the azimuth/elevation location technique which yields single pulse instantaneous emitter location, conventional triangulation, and multiple aircraft time difference of arrival, an extension of phase interferometry with spacing between antenna elements of miles instead of inches. V L

A82-45479 Moisture gradient considerations in environmental fatigue of CFRP. E. C. Edge (British Aerospace Public, Ltd., Co., Warton Div., Preston, Lancs., England). *Journal of Composite Materials*, vol. 16, July 1982, p. 285-300. 13 refs. Research supported by the British Aerospace Public, Ltd.

A theoretical method for calculating the moisture gradients utilizing the Fickian model normally employed to predict moisture content and profile is developed in order to assess the realism of accelerated conditioning and testing of CFRP specimens. The method is tested by applying it to four different conditioning regimes: natural weathering, a simulated flight condition, and environmental fatigue cycling without and with humidity variation during the test period. The results indicate that the inclusion of humidity variation during the test period may decrease rather than increase the realism of the test regime when compared with actual service life. It is concluded that this method is of general applicability in assessing the realism of accelerated conditioning and testing of CFRP specimens. N B

A82-45499 # Why GE made a moteur d'aviation. B. H. Rowe (General Electric Co., Aircraft Engine Group, Cincinnati, OH). *Astronautics and Aeronautics*, vol. 20, Oct. 1982, p. 40-43.

A brief history and the current state of the aircraft engine industry are presented, in terms of market growth in the U.S. and overseas. The primary systems contributing to current market growth are the 150 passenger medium range airliner, a minimum of four types of commuter or regional type aircraft with 30-40 passenger capacities, and a possible 60-70 passenger transport and new combat aircraft. Several limits imposed on the international market are governmental protectionism, the need for import/export balance considering oil prices, financial risk, and technical risk. An example joint effort is the construction of the core engine (compressor, combustor, and turbine) by GE and SNECMA (constructed the fan and the power turbine), and other programs have ensued such as the DC-8 Series 70 re-engining program. R K R

A82-45538 * Self-tuning regulator design for adaptive control of aircraft wing/store flutter. T. L. Johnson (Bolt Beranek and Newman, Inc., Cam-

bridge, MA), C. A. Harvey, and G. Stein (Honeywell Systems and Research Center, Minneapolis, MN). *IEEE Transactions on Automatic Control*, vol. AC-27, Oct. 1982, p. 1014-1023. 17 refs. Contract No. F33615-77-C-3096, Grant No. NGL-22-009-124.

The application of the self-tuning regulator concept to adaptively control aircraft wing/store flutter instability is described. A simple design based on a reduced-order aircraft model has been successfully tested on a high-order simulation of an advanced aircraft, and performance was found to be comparable to another design using on-line maximum likelihood identification of plant parameters. The main advantage of the self-tuning regulator is its simplicity, while the main disadvantage is the inadequacy of prior performance guarantees. (Author)

A82-45608 High Order Languages /HOL/ for flight control applications. G. E. Heyliger (Martin Marietta Aerospace, Denver, CO). In: *Guidance and Control 1982, Proceedings of the Annual Rocky Mountain Guidance and Control Conference*, Keystone, CO, January 30-February 3, 1982. San Diego, CA, Univelt, Inc., 1982, p. 165-180. 13 refs. (AAS 82-020).

The role of High Order Programming Languages (HOLs) in production of general software is examined. The motivation stems from software productivity and quality issues. Review of several attributes of programming languages reveals highly leveraged approaches to improving both quality and productivity. Attributes examined include level, proceduralness and abstraction. Critical aspects of programming environments are also reviewed. Lack of suitable supporting environment is seen to be a major reason for lagging use of HOLs in avionic applications such as flight control. Recent developments with specific HOLs intended for embedded computer applications offer the promise of significant improvements in the ability to produce. An important aspect of these developments is a strong standardization thrust. (Author)

A82-45762 † Fundamentals of strength and aeroelasticity in flight vehicles (Osnovy prochnosti i aerouprugosti letatel'nykh apparatov). A. I. Makarevskii and V. M. Chizhov. Moscow, Izdatel'stvo Mashinostroenie, 1982. 240 p. 20 refs. In Russian.

Standard strength specifications are discussed, taking into account the development of methods for the determination of conditions and criteria regarding the strength of flight vehicles. In connection with the consideration of aeroelasticity, a description is presented of the development of theoretical and experimental methods which will provide solutions to basic problems related to flutter, reversal of control and divergence, and dynamic reaction in response to external excitation. Statistical strength concepts are investigated, giving attention to the development of theory and engineering design methods, and to statistical analysis methods for the study of the strength characteristics. Aspects of fatigue stress are also explored, and methods for obtaining the fatigue characteristics of aircraft structures are examined. G R

A82-45765 † The technology of the assembly of engines for flight vehicles (Tekhnologiya sborki dvigatelei letatel'nykh apparatov). A. N. Nikitin. Moscow, Izdatel'stvo Mashinostroenie, 1982. 272 p. 43 refs. In Russian.

The book consists of three sections. The first section is concerned with the fundamentals of the technology of the assembly of manufactured articles. Particular attention is given to the theoretical basis of the assembly process and the methods for implementing the assembly. The second section of the book is devoted to the characteristics of the technology of the assembly of gas-turbine engines. In the third section attention is given to the technology of the assembly of liquid-propellant rocket motors and units of spacecraft energy and engine devices. Technological methods assuring the reliability of the assembled units are considered along with aspects of assembly accuracy, the control of assembly parameters, the mechanization and automation of assembly processes, the planning of assembly operations, the assembly of component parts of gas-turbine engines, and questions of general gas turbine assembly. G R

A82-45771 † The automation of processes for producing aircraft engines /2nd revised and enlarged edition/ (Avtomatizatsiya tekhnologicheskikh protsessov v aviadvigatelistroenii /2nd revised and enlarged edition/). M. I. Evstigneiev. Moscow, Izdatel'stvo Mashinostroenie, 1982. 208 p. 19 refs. In Russian.

The general principles underlying the automation of production processes are discussed. It is noted that the control systems here can be the ordinary type, the adaptive type, or the game type. Control is usually exercised on the basis of time, path, velocity, or loading. In discussing production lines, a distinction is made between lines of continuous action, where the article is processed while being moved, and lines of periodic action, where the article is moved from one position to another and is not processed during displacement. The equipment used in automation is described. C R

A82-45775 † Honeycomb cored structures (Konstruktsii s sotovym zapolniteniem). V. F. Panin. Moscow, Izdatel'stvo Mashinostroenie, 1982. 152 p. 38 refs. In Russian.

The use of honeycomb sandwich structures in aircraft construction is discussed. The discussion covers the basic properties of honeycomb sandwich

structures, the use of various materials for the fabrication of this type of structure, and strength analysis of sandwich structures with allowance for the effects of technological and design factors. Attention is also given to the testing of sandwich structures and general design considerations. Honeycomb sandwich structures are compared with conventional stringer structures in terms of weight. V L

A82-45813 A modular automated approach to airfield weather systems D A Chisholm, R H Lynch, and J C Weyman (USAF, Geophysics Laboratory, Bedford, MA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 69-72

System features and functional characteristics of the Modular Automated Weather System developed by the USAF Geophysics Laboratory are described. Developed around the principle of low-cost microprocessors, MAWS has sensors located at three sites along a runway and at two levels on a 40 m tower. The ambient temperature, dewpoint temperature, and visibility are sampled every 12 sec, while wind data is acquired every 6 sec. The data is transferred once each minute by telephone to a supervisory microprocessor, and then further to the Air Weather Service headquarters for analysis and display. The results of two years of test operations have defined instruments suitable for automation, sensor siting requirements for flight-critical data gathering, confirmed the performance potential of microprocessor-based weather systems, and demonstrated the utility of short-range forecast guidance based on simple statistical models. Automation of a rotating beam ceilometer is outlined. M S K

A82-45815 Wind determination and wind shear detection from flight test and airline flight data. P Krauspe, M Swolinsky, and P Vörsmann (Braunschweig, Technische Universität, Brunswick, West Germany) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 79-86 10 refs. Research supported by the Deutsche Forschungsgemeinschaft

The instrumentation and operational principles of data acquisition systems on board two commercial aircraft for gathering information on wind shear in takeoff and landing situations are described. On-board wind determinations are enacted by subtracting the true airspeed from the inertial velocity observed in-flight, and transforming the data into a fixed earth coordinate system. Data are recorded of flow angles of the air relative to the aircraft, taking into account the angle of attack and angle of sideslip, and the true airspeed. Additionally, the flight path angles and magnitude of inertial velocity, as well as the true heading, pitch angle, and bank angle are accounted for. The Performance Maintenance Recorder on board an Airbus A 300 was programmed to gather data for four minutes during takeoff, from 1000 ft down during landing, and during go-around. Examples of wind profiles and direction profiles are provided, and the performance of extensive statistical analyses of computed wind profiles is indicated. M S K

A82-45816 Low level wind shear detection system for airport landing approach areas using the Bertin Doppler acoustic sounder /Sodar/ M P Huguet, R Zanelli, and J M Fage (Société Bertin et Cie, Plaisir, Yvelines, France) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 87-92

The operations and performance results of a triaxial monostatic Doppler Acoustic Sounder (Sodar) for shear detection are reported, particularly for operational data at the Nice, France airport. Data from a test station in Lyon were simultaneously gathered from instrumentation on a 300 m tower, from 250 radar tracked balloons, and from radiosondes for comparisons. Satisfactory accuracy led to installation of a system at the Nice airport, with data checking taking place over the telephone lines with other meteorological stations. Shear at Nice occurs 70 percent of the time, originating from a valley wind in the morning and night and a sea breeze in the afternoon. Sodar has revealed the bulk of vertical shear to take place in a 40 m interval between 100-200 m AGL, although transitional events occur closer to the ground. The shear was found to be typically 60 deg. M S K

A82-45817 Turbulence and wind shear experiments related to aircraft operation in the terminal area J T Lee (NOAA, National Severe Storms Laboratory, Norman, OK) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 93-101 21 refs

The results of experiments at the National Severe Storms Laboratory to demonstrate the usefulness of Doppler radar to aviation are reported. The radar used had a 1 MW peak power, a pencil beam antenna with a 0.8 deg beamwidth, and a 10 cm wavelength. Methods of implementing a satisfactory compromise with the inversely proportional unambiguous range and unambiguous velocity intervals of weather features measurable by Doppler radar are discussed, noting the use of longer wavelengths for severe storm environments. Test results for matching radar echoes with turbulence areas identified by aircraft at known locations are described. Data are presented for an observed mesocyclone, gust fronts, clear air turbulence, and clear air roll structures. M S K

A82-45818 A tower approach to slant visual range observation and prediction E B Geisler and D A Chisholm (USAF, Geophysics Laboratory, Bedford, MA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 111-114 6 refs

The results of tests of an instrumented tower approach for measurements and short-range prediction of glideslope slant visual range (SVR) as a source of airfield visibility information are presented. Three techniques for statistical predictions of visibility based on algorithms for analysis of forward scatter meter data taken from towers along the runway were investigated. The towers' instruments provided information on Category I 200 ft landing minimum and SVR conditions in the landing zone. Observations at 50-3000 ft were found to be sometimes only slightly different at any one point in time yet vary widely over time. Measurement pairs from several intervals over the 2500 ft height range of the towers were studied for prediction intervals ranging from 2-60 min, using a special class of the Markov chain. Observations from a 50 ft tower were found to be useful for Category II predictions, while a 100 ft tower was better for Category I SVR predictions, with both data sets being processed by means of an Equivalent Markov technique. M S K

A82-45820 Development and test of a tactical visibility sensor. E Y Moroz (USAF, Geophysics Laboratory, Bedford, MA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 125-127 6 refs

The program goals, apparatus, and performance tests results of a USAF-developed forward scatter visibility meter are reported. The instrument was developed for tactical base-airfield applications, and was required to be transportable, provide covert operations capability, and improve the chopper, reliability, range, and lamp performances of the current USAF forward scatter meter. The resultant apparatus, the tactical visibility meter (TVM), utilizes a tungsten halogen light source chopped at 292 Hz, Si photodiode, masking so that no directly transmitted light reaches the receiver, and a toroidal measurement volume of 0.05 cu m. Data is taken over the range of 20-50 deg, where a scattering function derived from data detected by the receiver is proportional to the scattering coefficient of various atmospheric conditions. Visibility ranges of 60-6000 m were found to be definable with the TVM, based on a contrast threshold of 0.05. M S K

A82-45821 The airplane manufacturer and meteorology W G Tank (Boeing Commercial Airplane Co., Seattle, WA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 129-133 7 refs

The uses of meteorological data by an aircraft manufacturer to aid in engine performance prediction, for economic performance analysis, for developing hazardous phenomena warning systems for aircraft, and for pollution control are outlined. Upper air data on headwinds and temperatures are analyzed statistically for determining engine combustion temperature and performance as well as serving for predictors of economics involved in various air routes. On-board wind shear monitoring systems comprise active and passive systems, taking data from the relative motions of the aircraft along with ground systems interrogation to establish the presence of dangerous conditions. Likewise, an IR radiometer can detect temperature gradients which are characteristic of shear conditions. Finally, applied meteorological research for air pollution and sound propagation modelling are discussed. M S K

A82-45822 Aircraft meteorological data relay /AMDAR/ J Graytys, R Decker, G Smidt, and J Sparkman (NOAA, Rockville, MD) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 135-145 8 refs

The engineering development, components, operations, and performance evaluation of satellite relay of on-board aircraft meteorological data to world-wide processing facilities are outlined. Information is gathered on wind vector, temperature, position, altitude, and time by the aircraft avionics and transmitted to a GEO meteorology satellite for relay to ground stations and subsequent transferral into the Global Telecommunications System. A total of 99 747s and one C-141 aircraft have been equipped with data transmittal and receiving equipment of either a meteorological optical auxiliary terminal (MOAT) or aircraft-to-satellite data relay (ASDAR) types. Data rates can be as high as one sample/sec. Commercial versions of the systems are projected for the year 1983-4. Results of engineering evaluations of profile analyses with ground truth data for comparisons are presented. M S K

A82-45823 * Aspects of clear air turbulence severity forecasting and detection. L J Ehemberger (NASA, Flight Research Center, Edwards, CA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings Boston, MA, American Meteorological Society, 1982, p 146-152 10 refs

Factors influencing the accuracy of the forecasts of incidences of clear air turbulence (CAT) are discussed, along with techniques for improved verification. Descriptive ranking terms for the intensity of CAT events, ranging from light to extreme, are developed, and meteorological parameters used for predictions are reviewed, including jetstream core location, vertical and horizontal wind shears, stable layers, tropopause height, trough speed, 500-mb vorticity, surface fronts, pressure centers and cyclogenesis, and wind speeds near mountain ridges. Methods of remote detection of CAT, particularly by using radiometry sensitive to the IR water vapor band, are noted to have had some success in detecting actual CAT events and decreasing false alarms. Statistical aspects of CAT encounter severity are discussed, including the establishment of confidence intervals for thresholds of detection of CATs of varying intensities. **M S K**

A82-45825 Heavy rain/wind shear accidents. J K Luers and P Haines (Dayton, University, Dayton, OH) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 157-159

5 refs

A summary is presented of research results obtained in connection with the development of computer models regarding the effects of heavy rain on aircraft aerodynamics, taking into account studies of the role which heavy rain may have played in wind shear attributed accidents. The rain factor appears to have contributed significantly to aerodynamic performance degradation in the two situations considered in the investigation as well as in other accidents and incidents studied. It is believed that heavy rain may be a significant factor in many other aircraft accidents, although this factor is generally overlooked. Attention is also given to aspects, components, and significance of aerodynamic roughness. **G R**

A82-45827 Aviation meteorology in the 1980's - A trend forecast. E Bromley, Jr (Soncraft, Inc., Washington, DC) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 165-168

Aviation weather services in the US are examined in terms of a brief historical overview, the services as a business, challenges to be met, and forecasting and dissemination in the 1980's. A 3.2% annual rate of increase of the number of aircraft handled under instrument flight rules is expected, and flight services and aircraft operations show a similar predicted growth. An expenditure exceeding \$320 million is anticipated before the end of the 1980's, and the downward manpower trend is expected to continue. In evaluating the state of aviation weather services, it is concluded that weather service may decrease the impact of weather on air traffic, and future considerations involve economic, regulatory, and institutional factors. In particular, studies focused on the terminal area are considered the most important, with the meteorologist furnishing vital weather information and working with an air traffic control specialist. **R K R**

A82-45828 The Center Weather Service Unit program /CWSU/ E M Gross (NOAA, National Weather Service, Silver Spring, MD) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 169-175

The CWSU program began in part as a result of a National Transportation Safety Board (NTSB) recommendation in 1977 (A-77-68). It called for the FAA to 'Formulate rules and procedures for the timely dissemination by air traffic controllers of all available severe weather information to inbound and outbound flight in the terminal area.' Attention is given to the specific responsibilities of CWSU meteorologists, the available equipment, the presentation of Center Weather briefings, the daily meteorological impact statement, the nationwide issuance of In-Flight Advisories, and an example for a Center Weather Advisory. Future developments are also examined, taking into account an improved telephone communication system between the Center and Flight Service stations, a new Remote Radar Weather Display System, and an Enroute Weather Display System. **G R**

A82-45829 Weather support for helicopter operations in the Gulf of Mexico. E M Gross (NOAA, National Weather Service, Silver Spring, MD) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 177-180

Helicopter use in the Gulf of Mexico is presented in terms of weather support programs. Landing minimums must be estimated before flight, and the latest weather observations before landing must be provided to ensure favorable landing conditions. A weather observation plan finalized in the spring of 1982 will provide surface observations and specials from 15 offshore locations between 09Z and 00Z (every two hours), and 20 onshore locations have been included which operate from 24 hours a day to three times a day. An Aviation Low Cost Weather Observing System will be tested by the FAA and NWS, and is expected to be able to measure a range of weather parameters which include wind speed, dew point, visibility and cloud height. A pilot report collection system has also

been designed, and the resulting forecast will be provided by the Weather Service Forecast Office. In addition, a low speed full-duplex uncontrolled circuit will be provided by the FAA so that operators will be able to transmit information at scheduled times. **R K R**

A82-45830 The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing. E M Gross, T Laufer (NOAA, National Weather Service, Silver Spring, MD), T R Mitchell (Mitre Corp., McLean, VA), and F J Steckbeck (FAA, Washington, DC) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 184-196. 19 refs

It is pointed out that one of the weakest components of current weather service is dissemination. A description is presented of the evolution of the Pilot Self-Briefing program and the joint National Weather Service-FAA Aviation Route Forecast (ARF) development effort. These two program efforts have been integrated so that users can directly acquire weather information tailored by the computer to their specific interests. One of the objectives of the ARF program is to provide the meteorologist with the capability to quickly describe meteorological variables through computer graphics. Attention is given to questions regarding the need for ARF, ARF concept and development, and ARF output processing rationale, the ARF output organization, Pilot Self-Briefing data reduction due to ARF, past ARF testing, ARF workstation design, and pilot briefing design. **G R**

A82-45832 Mesoscale convective complexes and general aviation. R A Maddox and J M Fritsch (NOAA, Environmental Research Laboratories, Boulder, CO) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 209-214. 9 refs

It is pointed out that the general aviation pilot is particularly vulnerable to 'weather' for a number of reasons. Weather continues to be a causative factor in approximately 40% of the fatal accidents involving general aviation. The present investigation is concerned with the impacts of Mesoscale Convective Complexes (MCCs) upon general aviation operations. The structure, evolution, and life-cycle of these convective weather systems are contrasted with 'idealized' conceptions of thunderstorm activity over the US. The most common idealization is that thunderstorms tend to occur in two basic modes of organization, including the frontal or prefrontal squall line and the 'air mass' storms. However, another type of thunderstorm weather system, the MCC, has recently been described by Maddox (1980). It is shown that MCCs are a type of thunderstorm weather system which threatens and impacts both general and commercial aviation. **G R**

A82-45834 The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures. A W Gambell (Weather Services International, Chicago, IL) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 229-231

A82-45835 Post analysis of aircraft accident environments. R E Cale (ERA Services, Inc., Cerritos, CA) In International Conference on Aviation Weather System, 1st, Montreal, Canada, May 4-6, 1981, Proceedings. Boston, MA, American Meteorological Society, 1982, p 239-243

The process of meteorological post-analysis of aircraft accidents is described and illustrated. The two components of the analysis are the determination of the conditions of the atmospheric environment at the time and place of the accident, and the evaluation of factors involved in the weather support services provided to the pilot. In addition to synoptic data such as surface observations, radar information, upper air soundings, satellite photographs and pilot reports, real-time analyses prepared by the National Meteorological Center are useful in defining the detailed analyses to be required. Meso- and synoptic-scale data are used to prepare time and cross-section analyses of localized derivable parameters, such as potential and virtual temperature, density and pressure altitude, and stability and shear indices. It was found that in many cases the knowledge of potential flight weather hazards among general aviation pilots was inadequate for the conditions under which the flights were made. **A B**

A82-45845 Airbus industrie and community noise. J Chausonet (Société Nationale Industrielle Aérospatiale, Paris, France) (SAAI, International Symposium on Transportation Noise, Pretoria, Republic of South Africa, Oct 21-23, 1981) Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal, vol 3, no 1, 1982, p 17-24. (Previously announced in STAR as N82-27865)

A82-45846 Aircraft noise reduction. R E Russell and J M Streckenbach (Boeing Commercial Airplane Co., Seattle, WA) (SAAI, International Symposium on Transportation Noise, Pretoria, Republic of South Africa, Oct 21-23, 1981) Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal, vol 3, no 1, 1982, p 25-30

A82-45847 Planning for noise impact around airports C G van Niekerk (South African Council for Scientific and Industrial Research, National Institute for Aeronautics and Systems Technology, Pretoria, Republic of South Africa) *Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal*, vol 3, no 1, 1982, p 31-35 10 refs

The factors involved in the zoning and control of residential development and land use around airports are considered. Attention is focused on problems relating to airframe noise, the noise still produced by an aircraft when its engines are completely inaudible, such as the noise generated by the turbulence created by an aircraft during its landing approach. Indices of noise levels, such as the 'effective perceived noise level,' are examined. Since the reduction of noise by modifications of airframes and engines is limited by technology, alternative attempts to reduce the disturbances caused by noise around airports must be designed. Procedures for noise assessment around airports in South Africa are discussed. In addition, projected systems for intercity air transportation using helicopters and similar aircraft are examined. N B

A82-45849 Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis A J Vermeulen (South African Council for Scientific and Industrial Research, National Institute for Aeronautics and Systems Technology, Pretoria, Republic of South Africa) *Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal*, vol 3, no 1, 1982, p 59-63

The potential of the finite element approach is investigated as a tool for the calculation of unsteady aerodynamic influence coefficients for practical complex aircraft configurations. The generation of an AIC-matrix at one Mach number and reduced frequency for a typical case of a fighter type aircraft with external stores is found to require approximately 1 1/2 hours of computing time on a CDC Cyber 174 computer. It is concluded that in the context of a complete aeroelastic analysis, this method is relatively slow, expensive, and also restrictive with regard to complex configurations. Thus, expanded finite element applications will require computers with greater speed and storage capacity. N B

A82-45850 Energy methods used in air combat performance comparisons B Wigdorowitz (South African Council for Scientific and Industrial Research, National Institute for Aeronautics and Systems Technology, Pretoria, Republic of South Africa) *Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal*, vol 3, no 1, 1982, p 64-69 7 refs

Techniques developed to assess performance comparisons of opposing combat aircraft and to devise combat tactics before actually engaging in aerial combat are reviewed. It is shown that for aircraft of comparable maneuverability the sufficient condition which guarantees capture, as formulated by Kelley (1975), is rarely met. It is determined that simplistic maneuver tactics can be formulated using performance comparison techniques which, although useful, are limited. However, more precise maneuver tactics utilizing differential game theory in conjunction with the specific energy diagrams are found to provide powerful techniques for combat performance comparisons. N B

A82-45851 Computational aerodynamics J J Badenhorst (South African Council for Scientific and Industrial Research, National Institute for Aeronautics and Systems Technology, Pretoria, Republic of South Africa) *Aeronautical Society of South Africa and South African Institute of Aeronautical Engineers, Journal*, vol 3, no 1, 1982, p 70-76 19 refs

The use of the relatively simple linearized inviscid approximation of the Navier-Stokes equations for aerodynamic computations is reviewed. It is shown that while this approximation method is less accurate than other methods possible at present, it requires far less computer speed and memory, and is extremely versatile. The linearized inviscid method can successfully predict pressure distributions, configuration loads, aerodynamic flutter, boundary layer drag, and separated flow and mutual interaction between bodies moving relative to each other. In addition, practical applications of this method are examined. N B

A82-45877 The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3 A R Wazzan and H Taghavi (California, University, Los Angeles, CA) *International Journal of Heat and Mass Transfer*, vol 25, Sept 1982, p 1321-1331 39 refs

The three-dimensional linear spatial stability of compressible flat plate boundary layers with heat transfer is investigated for the parallel flow assumption by obtaining amplification maps for the two and three-dimensional modes at Mach 3.0 and the ratio of wall to adiabatic wall temperature equal to 1.5, 1.25, 1.0, 0.8, 0.7, and 0.3. Results show that the stability of a given boundary layer cannot be determined simply on the basis of the critical Reynolds number. The observed variation of the transition Reynolds number with heat transfer at the wall (cooling and heating) is qualitatively predicted by linear instability theory, except for the transition reversal, as shown by computations for the first three-dimensional mode. In addition, the transition reversal is found to be predicted by the linear theory when by extended surface cooling the first three dimensional mode, which is monotonically stabilized with cooling, ceases to be important and the transition is then determined by the second two-dimensional mode. N B

A82-45981 The choice of technology for ATC radars I - Transmitters H W Cole (Marconi Radar Systems, Ltd., Chelmsford, Essex, England) *The Controller*, vol 21, Sept 1982, p 33-37

ATC radar technology was considered by members at the IFATCA conference, first by analyzing problems, and then by presenting various technologies. Operational requirements for the terminal area radar (TAR) include a data rate of 12 per minute, a range of 80-100 nmi, and a pulse duration of 1-1.5 microseconds for good range discrimination, and applicable technologies are antenna techniques, transmission techniques, and signal processing techniques. In terms of radiation frequency, 600 MHz is considered the most efficient. Coherence properties of the radar are considered, and transmitter alternatives are discussed. Lifetime, cost, efficiency, and size are among the parameters which must be considered in transmitter design. Design parameters for the proposed TWT and Multiple Transistor Modules are outlined. R K R

A82-46114 Exterior noise on the fuselage of light propeller driven aircraft in flight J Sulc (Ceskoslovenska Akademie Ved, Ustav Termomechaniky, Prague, Czechoslovakia), J Hofr (LET, Uherske Hradiste, Czechoslovakia), and L Benda (Vyzkumny a Zkusebni Letecky Ustav, Prague, Czechoslovakia) *Journal of Sound and Vibration*, vol 84, Sept 8, 1982, p 105-120 15 refs

The paper describes experimental studies of exterior noise (pressure fluctuations) on the fuselage of twin-engine, propeller driven light commercial aircraft in flight. Measurements were made by means of 31 flush mounted special static pressure probes. For the wide range of test conditions, pressure fluctuations depending on propeller rotation and on turbulent fluctuations on the wall were obtained. The contributions from these main sources of internal noise of the aircraft could be distinguished separately in the results. The experimental results show the in-flight effects on the wall pressure fluctuations of the propeller sound field, the boundary layer pressure fluctuations, the separated flow pressure fluctuations and the vortex field behind the propeller. The comparison of experimental results with numerical prediction of the aircraft exterior noise leads to some conclusions about the validity of some methods of prediction. A modified formula for the propeller near noise field, based on measured results, is derived. (Author)

A82-46132 † The effect of a weak shock wave on a wing of complex planform at supersonic velocities (Vozdeistvie slaboi udarnoi volny na krylo slozhnoi formy v plane pri sverkhzvukovykh skorostyakh) M I Nisht, A F Polovkov, and S A Popytalov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, July-Aug 1982, p 121-127 6 refs. In Russian

A method is proposed for calculating distributed and integral supersonic aerodynamic characteristics of a wing having a complex planform, including that of a flight vehicle, with allowance for interaction between the wing and a weak shock wave of random orientation. The problem is solved in a linear formulation. First, a boundary-value problem is solved for stepwise changes of kinematic parameters in time, a transition to arbitrary time dependences is then effected by using a convolution. V L

A82-46135 † An asymptotic theory of separated flow past low-aspect-ratio wings (Asimptoticheskaia teoriia otrynnogo obtekaniiia kryl'ev malogo udlineniia) S B Zakharov and G G Sudakov *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, July-Aug 1982, p 141-147 14 refs. In Russian

A high-order asymptotic theory and a corresponding computational algorithm are developed for analyzing separated flow past low-aspect-ratio wings with allowance for the effect of the trailing edge. The proposed computation method is demonstrated by an example involving symmetrical separated flow past a plane delta wing. The method is shown to require much less computer time than the panel method and the method of discrete vortices. V L

A82-46140 † An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist (Eksperimental'noe issledovanie raskhodnykh i tiagovykh kharakteristik chetyrekhsoptovogo ezhektora s zakrutkoi potoka) Iu A Lashkov and E A Shumilkina *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, July-Aug 1982, p 185-189. In Russian

The flow rate and thrust characteristics of a low-pressure axisymmetric ejector with four active nozzles evenly spaced around the ejector periphery have been investigated experimentally over a wide range of the relative pressure drop in the nozzles (up to 7), with and without flow twist. It is shown that, depending on the relative pressure drop, flow twist makes it possible to achieve a 10-20% increase in thrust and a 30-50% increase in ejection coefficient. V L

A82-46254 # Fitts' principles still applicable - Computer monitoring of fighter aircraft emergencies J Reising (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) and L Hitchcock (FAA, Technical Center, Atlantic City, NJ) In *Symposium on Aviation Psychology*, 1st, Columbus, OH, April 21, 22, 1981, *Proceedings*. Columbus, OH, Ohio State University,

A82-46255

1981, p 28-37 8 refs

Three types of computer-controlled alerting systems for combat aircraft cockpits are described. Advisory status indications have been shown to provoke more accurate response if the signals relayed to the pilot via a CRT change continuously in response to the time interval remaining in which operation of the aircraft in the reported condition can be safely performed. The inclusion of five levels of criticality in the F/A-18 display provided for an advisory, two caution, and two warning signals, depending on the seriousness of the malfunction. Additionally, a warning tone was added to the critical warning signal in order to command full pilot attention. Additional augmentation is possible by tailoring the level of the warning to fit the conditions of operation, e.g. on-the-ground as opposed to a combat situation. The diagnostic systems for aircraft are compared to medical diagnostic systems, and are noted to free the pilot for activities where human motivation and activity are involved in other than routine tasks. M S K

A82-46255 # The performance of warning systems in avoiding Controlled-Flight-Into-Terrain (CFIT) accidents J P Loomis and R F Porter (Battelle Columbus Laboratories, Columbus, OH) In Symposium on Aviation Psychology, 1st, Columbus, OH, April 21, 22, 1981, Proceedings Columbus, OH, Ohio State University, 1981, p 38-50 10 refs

This paper examines the performance of two systems to prevent Controlled-Flight-Into-Terrain accidents, including their development and preimplementation issues and attitudes. The airborne version, the Ground Proximity Warning System, was required for certain large turbine-powered airplanes. The ground-based system, the Minimum Safe Altitude Warning, is a feature of the ARTS-3 system. Accident data from National Transportation Safety Board (NTSB) and reports from the Aviation Safety Reporting System (ASRS) were used in assessing performance. It is concluded that these systems have dramatically reduced accidents. Although false and nuisance alarms continue, no evidence suggests that they have caused any accident. The tenacity of the alarms - especially the GPWS - as well as appropriate triggering criteria seem to be basic to their success. (Author)

A82-46387 # Altitude estimation using asynchronous alpha-beta tracking filters. R E Lefferts (FAA, Analysis Branch, Atlantic City, NJ) *IEEE Transactions on Aerospace and Electronic Systems*, vol AES-18, July 1982, p 469-477 25 refs

In the analysis of the alpha-beta tracking filter it is usually assumed that the tracking filter and data source operate in synchronism at a constant data rate. However, in a multisensor environment in which the tracking algorithm operates at fixed intervals, the tracking filter cannot be synchronized with the sensors. An analytical solution is obtained for the case in which the tracking filter and data source operate asynchronously with a 'time-correction' process used to approximate the synchronous operation of the tracking filter. An example is given in which the effects of data quantization on the performance of an altitude tracking filter for air traffic control are examined. It is shown that the asynchronous operation of the tracking filter in the example without the time-correction process will result in significant errors in the predicted altitude. (Author)

A82-46529 Selected furnace brazed components for the aerospace industry W T Hooven, III (Vac-Hyd Corp., Boston Metallurgical Div., Woburn, MA) (*American Welding Society and Welding Research Council, International Brazing and Soldering Conference, 13th, Kansas City, MO, Apr 27-29, 1982*) *Welding Journal*, vol 61, Oct 1982, p 15-20

Furnace brazed aerospace components are reviewed with reference to four major groups based on the type of filler material used for the joining process, i.e. silver (1150-1950 F), gold (1700-1950 F), nickel (1700-2250 F), and copper (2000-2100 F). All furnace brazing applications discussed are processed in either vacuum or dry hydrogen protective atmosphere furnaces. The vacuum furnaces are of the modern cold-wall molybdenum heating element construction with rapid argon or nitrogen gas quench systems. The hydrogen atmosphere furnaces are of the sand-seal retort type. Specific components examined include a fuel distribution block for a gas turbine engine, a jet engine compressor stator vane and shroud assembly, an engine fuel manifold assembly, missile guidance components, and miniature electronic enclosures. V L

A82-46603 † Integral characteristics in the computer-aided design of geometrical objects of complex configuration (Integral'nye kharakteristiki v SAPR geometricheskikh ob'ektov slozhnykh tekhnicheskikh form) R Kh Akhatov *Aviatsionnaia Tekhnika*, no 2, 1982, p 13-18 In Russian

The paper examines aspects of the determination of the integral characteristics of geometrical objects on the basis of a unified approach to the construction of algorithms and the implementation of software. Algorithms for determining such integral characteristics are presented, and the characteristics of the associated programs are discussed. The present study is directed toward the development of a CAD subprogram for computing the technical characteristics of a geometrical object. B J

A82-46607 † Optimization of dispatching discipline in queueing systems with limited queues (K optimizatsii diszipliny obsluzhivaniia v sis-

temakh massovogo obsluzhivaniia s ogranichennoi ochered'iu) I Kh Sadykov *Aviatsionnaia Tekhnika*, no 2, 1982, p 30-35 12 refs In Russian

The paper presents an approximate algorithm for finding optimal static relative priority for a queueing system with a limited queue. Optimal dynamic priority is determined by solving a system of quasi-linear algebraic equations. The minimum-loss transition from this dynamic priority to a static priority is examined. B J

A82-46608 † Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing (Vybór vesovykh koeffitsientov v zadache optimal'nogo dempfirovaniia uprugikh kolebanií kryla) T K Sirazetdinov and I Kh Khalitov *Aviatsionnaia Tekhnika*, no 2, 1982, p 35-40 6 refs In Russian

An algorithm is developed for the design of an optimal damping system for an elastic wing in the case of prespecified requirements on the critical rate of flutter and on the transient-response indices of the bending-torsional oscillations of the wing. An analysis of the feedback coefficients and the transient response indicates that torsional strain rate has an important effect on the optimal damping control. B J

A82-46617 † Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating (Variatsionnoe uravnenie eksentrichno podkreplennoi paneli s uchétom neravnomernogo nagreva) L M Kurshin and A I Ianson *Aviatsionnaia Tekhnika*, no 2, 1982, p 66-69 In Russian

Nonuniform aerodynamic heating of the structural elements of a flight vehicle can cause the skin and stringer of a reinforced panel to have different temperatures, which affects the critical loading of the panel and the supercritical behavior of the skin. This paper derives a variational equation for an eccentrically reinforced panel, with allowance for thermal stresses. Maximum deflections of the panel are investigated as a function of compression load, with allowance for initial deflection under nonuniform heating, under combined loading, and for various eccentricities of reinforcement. B J

A82-46619 † Measuring flexural loads by means of strain transducers (Ob izmerenii izgibaushchikh nagruzok navesnymi elektrotenzometricheskimi preobrazovateliami) A P Loktionov *Aviatsionnaia Tekhnika*, no 2, 1982, p 73-75 6 refs In Russian

Measuring schemes are presented in which flexural and shear strain transducers mounted on the landing gear struts of an aircraft are used to determine the aircraft parking weight and its center of gravity. The parameters of the measuring scheme and the conversion function for the system loaded element-transducer are obtained analytically by solving a system of equations describing the displacements of the strain transducer mounts and transducer operation. A numerical example is given showing that shear strain must be taken into account in actual measurements on the landing gear. V L

A82-46620 † Parameterization in the design of surfaces by means of Coons' method (Parametrizatsiia pri proektirovanii poverkhnosti po metodu Kuns'a) F F Lukmanov *Aviatsionnaia Tekhnika*, no 2, 1982, p 75-78 In Russian

Coons' (1968) approach to the design of surfaces in computer-aided aircraft design is considered. A method for parameterizing the curves of the grid defining the surface is presented, which makes it possible to simplify the process of surface specification. B J

A82-46621 † A study of wing vorticity patterns (Issledovanie vikhrevykh skhem kryla) V I Men'shikov and M M Ovcharov *Aviatsionnaia Tekhnika*, no 2, 1982, p 78, 79 In Russian

The problem of nonseparated flow of ideal incompressible fluid past a wing of finite aspect ratio involves the solution of a singular integral equation. In a commonly used approximate method of solution, sums are substituted for the integrals, which is equivalent to the substitution of discrete vortices for the wing vorticity surface. A new arrangement of vortices on a plate of finite aspect ratio is proposed whereby vortices parallel to the wing chord are evenly spaced over the wing span with respect to the angular coordinate. The proposed scheme is shown to provide acceptable accuracy even with as few as two vortices. V L

A82-46628 † An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method (Algoritm realizatsii metoda polinomial'nogo obvoda, invariantnyi otnositel'no iskhodnykh danykh) L G Mezentshev *Aviatsionnaia Tekhnika*, no 2, 1982, p 97-99 In Russian

An algorithm that is invariant relative to the initial data is developed for the implementation of the polynomial contouring method in computer-aided design or manufacturing. The algorithm, implemented in FORTRAN-4, involves the construction of a series of Sturm functions and the determination of the sign-constancy intervals of the terms of the series. B J

A82-46692 † Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection (issledovanie aerodinamiki osesimmetrichnykh tel v sverkhzvukovom potoke pri nalichii lokalizovannogo vduva) V A Antonov and A M Grishin *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, July-Aug 1982, p 86-92 26 refs In Russian

Systematic calculations are presented of supersonic flow past blunt bodies with large gas injection through porous sections of finite length of the lateral surface. It is shown that, under certain conditions, a significantly unsteady flow regime occurs which is accompanied by pulsations of the contact discontinuity, and the pressure and velocity field. It is also shown that, for each mass flow rate of injection, there exists an optimal length of porous section, at which the head resistance of the body is minimal. A zone of reverse flow can occur in the case of localized injection at the surface of the body. B J

A82-46693 † The effect of a screen on the aerodynamic characteristics of an oscillating profile (Vlianie ekrana na aerodinamicheskie kharakteristiki kolebiushchegosia profilja) V A Algazin *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, July-Aug 1982, p 92-98 10 refs In Russian

An analysis is presented of the flutter of a thin profile in an ideal incompressible fluid near a rigid rectilinear screen in a nonlinear formulation in which the shape of the vortex sheet behind the profile is not specified beforehand but is determined in the process of solving the problem. This problem is solved by the method of discrete vortices. Results are presented on the aerodynamic characteristics of an oscillating profile, as well as on the dependence of the characteristics of a fluttering wing on Strouhal number, oscillation amplitude, and relative distance to the screen. B J

A82-46801 # Two-dimensional apparent masses for cross-flow sections of wing-store configurations M-K Huang *ASME, Transactions, Journal of Applied Mechanics*, vol 49, Sept 1982, p 471-475 20 refs

On the basis of the assumption that the external stores are small compared with the wing, an approximate method has been developed for estimation of two-dimensional apparent masses for the cross-flow sections of wing-store combinations. The results obtained may be applicable to the analysis of the effects of the stores on the aerodynamic stability derivatives in slender-body theory. The theory has also been applied to estimate the rolling moment due to sideslip for high-wing configurations. The presented results are in agreement with those of other investigations. (Author)

A82-46831 † Heat transfer from nozzles under the conditions of flow laminarization (Teploobmen v soplakh v usloviakh laminarizatsii potoka) N N Koval'nogov (Kazanski Aviatsonnyi Institut, Kazan, USSR) *Promyshlennaya Teplotekhnika*, vol 4, Sept-Oct 1982, p 59-64 12 refs In Russian

Heat transfer from the subsonic section of axisymmetric nozzles of various configurations has been studied experimentally under the conditions of boundary layer laminarization. In the experiments, the maximum value of the acceleration parameter K varied in the range 6.5-37.5 $\times 10$ to the 6th, in the inlet section the velocity profile was that of developed turbulent flow, and a thermal boundary layer started to form at the same moment that flow acceleration began. Experimental data are generalized in the form of a heat transfer law. V L

A82-46832 † Modeling of thermal effects when investigating the thermal fatigue life of the blades of a gas-turbine engine (Modelirovanie teplovyykh vozdeystvii pri issledovanii termoustalostnoi dolgovечnosti lopatok GTD) L V Kravchuk (Akademiya Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR) *Promyshlennaya Teplotekhnika*, vol 4, Sept-Oct 1982, p 91-95 6 refs In Russian

Problems associated with the modeling of the thermal state of gas turbine blades during testing on a gasdynamic test stand are discussed with emphasis on those cases where similarity of the boundary conditions of heat transfer cannot be achieved. A blading design method is proposed which makes it possible to obtain thermal and stressed states close to those observed under actual service conditions in the regions of thermal stress concentration. The required local heat flows are achieved by programmed control of the gas flow temperature. V L

A82-46847 # Nonlinear transonic flutter analysis. C J Borland and D P Rizzetta (Boeing Military Airplane Co., Seattle, WA) (*American Institute of Aeronautics and Astronautics, Dynamics Specialists Conference, Atlanta, GA, Apr 9, 10, 1981, Paper 81-0608*) *AIAA Journal*, vol 20, Nov 1982, p 1606-1615 41 refs Contract No F33615-78-C-3201

A numerical procedure is presented for predicting the static and dynamic aeroelastic characteristics of thin, clean swept wings in transonic flow. The method is based upon the simultaneous time integration of the equations governing the coupled nonlinear fluid dynamic and structural aeroelastic system. Governing equations for the system are developed and the numerical algorithm, including the coupling procedure for their solution, is discussed. As a computational example, the flutter of a simple rectangular wing is considered. Solutions are presented for a range of Mach numbers and dynamic pressures and com-

pared to other existing flutter analysis methods including doublet lattice, modified strip theory, and time linearization. Unlike other procedures, the method presented here is capable of predicting the nonlinear interaction between unsteady shock wave motions and the dynamic response of an elastic wing. Computed results indicate the existence of the 'transonic bucket'. (Author)

A82-47010 # Romanian professor Elie Carafoli - 55 years devotion to modern aeronautics and astronautics. F Zaganescu (Romanian Academy of Sciences, Commission on Astronautics, Bucharest, Rumania) (*International Astronautical Federation, International Astronautical Congress, 33rd, Paris, France, Sept 27-Oct 2, 1982, Paper 82-280*) 10 p 6 refs

A82-47069 # Development of high loading, high efficiency axial flow turbine. K Takeshima, Y Tonomura (Mitsubishi Heavy Industries, Ltd., Engine Dept., Nagoya, Japan), T Satoo (Mitsubishi Heavy Industries, Ltd., Takasago Institute, Takasago, Japan), H Nouse, M Minoda, and K Takahara (National Aerospace Laboratory, Chofu, Tokyo, Japan) (*Japan Society for Aeronautical and Space Sciences, Transactions*, vol 25, Aug 1982, p 91-103 9 refs)

Results of an experimental investigation of a high loading, high efficiency, axial flow turbine are presented. A numerical model is developed for the streamline along the stages using the Euler equation of radial motion. A tailored spanwise static pressure distribution is found to be available by control and combination of the vortex and meridional velocity distribution. An analytical method was employed to minimize the rate of diffusion on the airfoil blade surface and tailor the surface pressure diffusion pattern to improve blade performance at higher loading levels. Comparisons with predictions were made with a single stage turbine which simulated the second stage of a high bypass 10,000 lb thrust four stage turbine in a wide range of operating conditions. Two-dimensional and cold flow rig tests were performed. The resulting data confirmed the theoretical predictions on efficiency improvements. M S K

A82-47072 Harpoon missile captive-carry dynamic environments on the A-6E aircraft. J A Zara, R W Elton, and J L Gubser (McDonnell Douglas Astronautics Co., St Louis, MO) (*Institute of Environmental Sciences, Annual Technical Meeting, 28th, Atlanta, GA, Apr 21-23, 1982*) *Journal of Environmental Sciences*, vol 25, Sept-Oct 1982, p 15-23 5 refs

The results of flight tests of the US Navy Harpoon Anti-Ship Missile, integrated with the A-6 Intruder attack aircraft, are presented which were conducted to measure captive-carry dynamic environments. Catapult launch, arrested landings, and a variety of flight conditions were examined, and acoustic, shock, and vibration wideband measurements were performed at key locations using an instrumented missile. Three flight configurations were flown to assess missile environments at different wing stations and to determine the influence of an adjacent store, while level flight and maneuver conditions were measured over a wide range of aircraft speeds and altitudes. Among other results, it was found that the transient response measurements obtained during catapult launch and arrested landing tests are relatively low in magnitude. Arrested landing shock response is found to be highly coupled in all three measurement directions with the overall maximum missile response measured in the forward end of the missile. In addition, captive flight test data indicate reasonably uniform vibration response levels forward in the missile while levels measured at the aft end are significantly higher. Acoustic levels at the aft end of the missile are considerably higher than those measured on the forward end. N B

A82-47073 A random vibration test for the evaluation of stiff sensitive component parts. R W Nankey (General Electric Co., Aircraft Equipment Div., Utica, NY) (*Institute of Environmental Sciences, Seminar on Designing Electronic Equipment for Random Vibration Environments, Los Angeles, CA, Mar 25, 26, 1982*) *Journal of Environmental Sciences*, vol 25, Sept-Oct 1982, p 30-33 5 refs

A test method is developed for simulating the effects of a high level random vibration environment on a class of component parts which is used in airborne electronic equipment. These components, designated as stiff components, are characterized by having their resonant frequencies above the upper frequency limit of the applied vibration spectrum and by being structurally or functionally sensitive to the effects of vibration. A narrowband random vibration test is developed, which is found to be capable of closely reproducing failure modes in stiff components that occur during vibration testing and service use in airborne electronic units. A resonant vibration fixture which serves as a vibration amplifier is used to apply the very high levels of narrowband random vibration to stiff components that are often required by an appropriate vibration test. N B

A82-47093 † Observability of the parameters of an inertial navigation system for a 360-deg coordinated turn (O nabludaemosti parametrov inertsial'noi navigatsionnoi sistemy na pravi'nom virazhe) V M Morozov, A I Matasov, and A G Shako'tko (*Akademiya Nauk SSSR, Izvestia, Mekhanika Tverdogo Tela*, July-Aug 1982, p 21-26 5 refs In Russian)

The possibility of using a 360-deg coordinated turn to perform position and velocity corrections in an inertial navigation system is examined. An analysis is

presented of the observability of the parameters of such a system in the case of a 360-deg coordinated turn B J

A82-47157 **An investigation of ring laser gyroscope random walk experiments** G L Wray and D J Flynn (Royal Aircraft Establishment, Farnborough, Hants, England) In Symposium Gyro Technology 1981, Proceedings of the Symposium, Stuttgart, West Germany, September 23, 24, 1981

Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1982, p 7 0-7 29 13 refs

Two experimental techniques to quantify random walk in a dithered ring laser gyroscope (RLG) are assessed by means of computer simulation and the application of statistical theory to a random walk process. The RLG is described with emphasis on the output characteristics and error sources which have particular impact on the strapdown system design. A simplified phenomenological computer model of the device is constructed. It is found that constant time experiments to quantify random walk in an RLG lead to a correct and unique value of the random walk characteristic k provided that care is taken in the experimental procedure to ensure good statistics and to minimize the effect of angular quantization noise. Constant angle experiments only give rise to the correct value of k when the total angle collected is heavily dominated by constant angular rate C D

A82-47224 **Automation in the skies** D Allison *High Technology*, vol 2, Nov-Dec 1982, p 40-44, 46, 47, 113 5 refs

Details of a 20-yr program to automate the U.S. air traffic control system are reviewed. The FAA will initially place large host computers at traffic control centers and terminal hubs, and will use current software until 1990, when new programs will be introduced. COMMUNICATION between aircraft and ground stations will be computerized, including a Mode S beacon for air crew access to ground-based flight and weather data. Microwave landing systems will begin operations by the year 1985. Aircraft will carry collision avoidance equipment with automated alarms, with the same equipment providing a link to the Mode S beacon system, installation in both commercial and general aviation aircraft will be implemented. Displays in the cockpit direct the pilot toward safe paths and speeds, and also provide the identity and path of nearby aircraft. Operations with the automated en route air traffic control (AERA) system are outlined M S K

A82-47229 † **Prediction of fatigue crack propagation in plane specimens and thin-walled structural elements of aircraft wing skin under programmed loading** (O prognostirovani razvitiia ustalostnykh treshchin v ploskikh obraztsakh i tonkostennykh konstruktivnykh elementakh obshivki kryla samoleta pri programnom nagruzhении) N A Khodak (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) *Problemy Prochnosti*, Sept 1982, p 28-33 12 refs In Russian

A method is proposed for predicting fatigue crack propagation which is based on the relationship between the fatigue crack propagation rate and the stress intensity factor. The method is applicable to structural elements with cracks for which the relationship between the stress intensity factor and the crack length is known (either in analytical or graphical form). The proposed method makes it possible to predict the fatigue crack propagation rate or the number of loading blocks for a given element under conditions simulating actual in-service conditions. Factors related to the accuracy of fatigue crack growth predictions under programmed loading are examined V L

A82-47407 **Maximum-entropy spectral analysis of radar clutter** S Haykin, B W Currie, and S B Kesler (McMaster University, Hamilton, Ontario, Canada) *IEEE, Proceedings*, vol 70, Sept 1982, p 953-962 18 refs. Research supported by the National Sciences and Engineering Research Council and Department of National Defence of Canada

The paper reviews a processor that uses the maximum-entropy spectral estimate to provide a set of Doppler-based features for classifying the different forms of radar clutter as encountered in an air traffic control environment. This enables vectoring aircraft around an area that is made hazardous by the presence of major weather disturbances or migrating flocks of birds. An overview is given of experimental results that demonstrate the practical viability of this Doppler processor (Author)

A82-47493 * **Two-frequency Delta k /microwave scatterometer measurements of ocean wave spectra from an aircraft** J W Johnson, W L Jones (NASA, Langley Research Center, Hampton, VA), and D E Weissman (Hofstra University, Hempstead, NY) In Oceanography from space, Proceedings of the Symposium, Venice, Italy, May 26-30, 1980 New York, Plenum Press, 1981, p 607-616 7 refs

A technique for remotely sensing the large-scale gravity wave spectrum on the ocean surface using a two frequency (Delta k) microwave scatterometer has been demonstrated from stationary platforms and proposed from moving platforms. This measurement takes advantage of Bragg type resonance matching between the electromagnetic wavelength at the difference frequency and the length of the large-scale surface waves. A prominent resonance appears in the

cross product power spectral density (PSD) of the two backscattered signals. Ku-Band aircraft scatterometer measurements were conducted by NASA in the North Sea during the 1979 Maritime Remote Sensing (MARSEN) experiment. Typical examples of cross product PSD's computed from the MARSEN data are presented. They demonstrate strong resonances whose frequency and bandwidth agree with the surface characteristics and the theory. Directional modulation spectra of the surface reflectivity are compared to the gravity wave spectrum derived from surface truth measurements (Author)

A82-47496 **A comparison of Seasat-derived wave height with surface data** P Queffelec (Bretagne Occidentale, Université, Brest, France), A Braun (COB Antenne Météo, Brest, France), and C Brossier (Centre National d'Etudes Spatiales, Groupe de Recherches de Géodésie Spatiale, Toulouse, France) In Oceanography from space, Proceedings of the Symposium, Venice, Italy, May 26-30, 1980 New York, Plenum Press, 1981, p 637-643

Seasat data on wave height are compared with shipborne measurements for various wave heights (0-8 m) and about a hundred data points. The agreement is found to be generally good, no bias is observed, and a large part of the standard deviation is due to the visual ship observations of seastate. The Seasat wave-height is also compared with the predictions of DSA 5, a spectral forecasting wave model, and differences between the two sets of data are examined V L

A82-47944 **Analysis of tapered-land hybrid aerostatic journal bearings** S S Pande and S Somasundaram (Indian Institute of Technology, Bombay, India) *Wear*, vol 81, Sept 15, 1982, p 97-107 7 refs

Results of the analysis of hybrid (aerostatic and aerodynamic) tapered-land journal bearings are presented. For a known bearing geometry, the Reynolds equation is reduced to a set of partial differential equations by using a first-order perturbation method. These differential equations are solved by a finite-difference numerical technique. The effects of various design and operational parameters on the load-carrying capacity and the attitude angle of the bearing were studied. The results are expressed in terms of non-dimensional parameters to enable their direct use for design purposes (Author)

A82-48025 **Aquila - Robot eye in the sky** G Warwick *Flight International*, vol 122, Oct 2, 1982, p 992-994

Design and operational features of the Lockheed developed Aquila RPV are described. The vehicle was introduced in 1975 and, after 23 first-generation models, is currently a 13 ft span flying wing with a Kevlar composite structure. The power plant is a 26 hp two-stroke, two cylinder, horizontally opposed piston engine driving a 26 in diameter, two-blade, ducted wooden pusher propeller and a 1.5 kW alternator. Flight control is automatic and navigation is by dead reckoning with periodic position updates through a jam-resistant uplink. Preprogrammed control includes launch, waypoint navigation, search, orbit, and recovery, with figure eight and Saccatrac loiter patterns. Aquila will initially carry only a black and white television camera with three fields of view, autotracker, laser rangefinder/designator, and stabilized optics. A day/night Flir package will be added later, and operational status is set for 1987 M S K

A82-48257 **A review of the history of nondestructive testing in Japan** G Itoh *Materials Evaluation*, vol 40, Oct 1982, p 1138, 1140, 1141

Technical data concerning the radiographic testing of tie metal arc-welded joints for the naval land-based attack bombers manufactured in Japan since 1938 are reviewed. Consideration is given to the general design of the attack bombers, details of tie metals, radiographic testing techniques and testing facilities, and acceptance standards. The data are then examined in terms of present-day radiography and it is shown that current numerical acceptance standards, as far as porosity is concerned, may not be as appropriate from a practical standpoint in the case of the tie metal welds as the geometrical acceptance standards of half a century ago V L

A82-48264 † **Airfield construction - A reference book** (Stroitel'stvo aerodromov - Spravochnik) B I Demin, V P Egozov, and Iu A Ratiuk Moscow, Izdatel'stvo Transport, 1980 248 p 38 refs In Russian

The basics of airfield construction are reviewed with reference to construction work organization, management, and execution, construction materials, and machinery and equipment. Consideration is given to the construction of drainage systems, unpaved airfields, concrete pavements, the manufacture of organic binders, concrete and cement products, quality control in airfield construction, and maintenance. Finally, the fundamentals of safety engineering are discussed in relation to the various stages of airfield construction V L

STAR ENTRIES

N82-32301# Shock and Vibration Information Center (Defense), Washington, D C
THE SHOCK AND VIBRATION DIGEST, VOLUME 14, NO. 7 Monthly Report

Ronald L Eshleman, ed, Judith Nagle-Eshleman, ed, and Milda Z Tamulionis, ed Jul 1982 121 p refs
 (AD-A117323) Avail SVIC, Code 5804, Naval Research Lab, Washington, D C 20375 CSCL 20/11

Transonic blade flutter, active control technology in aircraft, and wind-excited behavior of structures are discussed

N82-32303# Loughborough Univ of Technology (England) Dept of Transport Technology

ACTIVE CONTROL TECHNOLOGY IN AIRCRAFT

D McLean /n Shock and Vibration Information Center The Shock and Vibration Digest, Vol 14, No 7 Jul 1982 p 11-22 refs

Avail SVIC, Code 5804, Naval Research Lab, Washington, D C 20375 CSCL 01C

Developments in active control technology on aircraft are described The following functions are described relaxed static stability, maneuver load control, fatigue reduction, ride control, flutter mode control, and gust load alleviation Author

N82-32305# Army War Coll, Carlisle Barracks, Pa
FOREIGN (TURBINE POWERED) HELICOPTER PRODUCTION: A THREAT TO THE UNITED STATES PRODUCTION BASE

James E Gauze 28 Apr 1982 34 p refs

(AD-A116755) Avail NTIS HC A03/MF A01 CSCL 05/3

The trends in world helicopter sales, the preceptions held by potential buyers, the market growth through the end of the 1980's, are addressed The more significant disincentives which maybe placing the U S industry in less than a fully competitive position are discussed GRA

N82-32307# Air Force Human Resources Lab., Wright-Patterson AFB, Ohio Logistics Research Branch.

MAINTENANCE SUPPORT RESOURCE FORECASTING MODELS. VOLUME 2: EQUIVALENCE TESTING OF RELIABILITY AND MAINTENANCE MODEL AND EXPECTED VALUES MODEL Final Technical Paper

Sharon R Nichols Brooks AFB, Tex Jun 1982 57 p Submitted for publication

(AD-A117149, AFHRL-TP-82-12(2)) Avail NTIS HC A04/MF A01 CSCL 05/2

Three maintenance support resource forecasting models were developed They are the logistics composite model (LCOM), reliability and maintainability model (R&M), and the expected values model (EVM) These three models were analyzed in terms of: (1) how they relate to each other, (2) the minimal data requirements of each model, (3) how the models can best be used in the weapon system acquisition process, and (4) whether the models generate roughly equivalent results All three models were compared in terms of input requirements, method of processing, and output products The results of the equivalence testing for the two average value models are included The results of the equivalence testing for the two average value models are included GRA

N82-32308# European Space Agency, Paris (France)
MATHEMATICAL MODEL FOR A MAINTENANCE PROGRAM FOR MODERN JET AIRCRAFT

Rudolf Pnzn, Hans-Christian Goetting, Karl-Heinz Galda, and

Juergen Kreth Mar 1982 50 p refs Transl into ENGLISH of "Math Modell fuer eine Instandhaltungsphil moderner Verkehrsflugzeuge" rept DFVLR-FB-81-14 DFVLR, Brunswick, Oct 1980 43 p
 (ESA-TT-724, DFVLR-FB-81-14) Avail NTIS HC A03/MF A01, original German version available from DFVLR, Cologne DM 10,40

Step-by-step extension of structural inspection intervals, based on long-term experience in operating a fleet of commercial aircraft, is described by a mathematical model The model is founded on the statistical distributions for stress and for the appearance of a detectable incipient crack in fatigue-stressed components By assuming realistic values for failure probability, the admissible inspection intervals can be calculated The result is an extension of the intervals up to a maximum level, followed by a reduction in the intervals as the anticipated value for detectable incipient cracks is approached Model results are very similar to those obtained in practice Author (ESA)

N82-32312*# Pennsylvania State Univ, University Park Dept of Aerospace Engineering

COMPUTER PREDICTION OF THREE-DIMENSIONAL POTENTIAL FLOW FIELDS IN WHICH AIRCRAFT PROPELLERS OPERATE M.S. Thesis

Stephen J Jumper Aug 1982 253 p refs

(Grant NsG-1308)

(NASA-CR-169317, NAS 1 26 169317) Avail NTIS HC A12/MF A01 CSCL 01A

A computer program was developed to calculate the three dimensional, steady, incompressible, inviscid, irrotational flow field at the propeller plane (propeller removed) located upstream of an arbitrary airframe geometry The program uses a horseshoe vortex of known strength to model the wing All other airframe surfaces are modeled by a network source panels of unknown strength which is exposed to a uniform free stream and the wing-induced velocity field By satisfying boundary conditions on each panel (the Neumann problem), relaxed boundary conditions being used on certain panels to simulate inlet inflow, the source strengths are determined From the known source and wing vortex strengths, the resulting velocity fields on the airframe surface and at the propeller plane are obtained All program equations are derived in detail, and a brief description of the program structure is presented. A user's manual which fully documents the program is cited Computer predictions of the flow on the surface of a sphere and at a propeller plane upstream of the sphere are compared with the exact mathematical solutions Agreement is good, and correct program operation is verified Author

N82-32313*# Pennsylvania State Univ, University Park Dept of Aerospace Engineering

THE DYNAMIC FLEXURAL RESPONSE OF PROPELLER BLADES M.S. Thesis

Slobodan Zivadin Djordjevic Nov 1982 226 p refs Sponsored in part by NASA

(NASA-CR-169318, NAS 1 26 169318) Avail NTIS HC A11/MF A01 CSCL 01A

The determination of the torsional constants of three blade models having NACA four-digit symmetrical airfoil cross sections is presented Values were obtained for these models analytically and experimentally Results were also obtained for three other models having rectangular, elliptical, and parabolic cross sections Complete modal analyses were performed for five blade models The identification of modal parameters was done for cases when the blades were modeled as either undamped or damped multi-degree-of-freedom systems For the experimental phase of this study, the modal testing was performed using a Dual Channel FFT analyzer and an impact hammer (which produced an impulsive excitation) The natural frequency and damping of each mode in the frequency range up to 2 kHz were measured. A small computer code was developed to calculate the dynamic response of the blade models for comparison with the experimental results. A comparison of the undamped and damped cases was made for all five blade models at the instant of maximum excitation force.

The program was capable of handling models where the excitation forces were distributed arbitrarily along the length of the blade

Author

N82-32314*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN EXPERIMENTAL STUDY OF DYNAMIC STALL ON ADVANCED AIRFOIL SECTIONS. VOLUME 1: SUMMARY OF THE EXPERIMENT

W J McCroskey, K W McAlister, L. W. Carr, and S L Pucci
Jul 1982 102 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif (NASA-TM-84245, A-8924, NAS 1 15 84245, USAAVRADCOM-TR-82-A-8) Avail NTIS HC A06/MF A01 CSCL 01A

The static and dynamic characteristics of seven helicopter sections and a fixed-wing supercritical airfoil were investigated over a wide range of nominally two dimensional flow conditions, at Mach numbers up to 0.30 and Reynolds numbers up to 4×10^6 to the 6th power. Details of the experiment, estimates of measurement accuracy, and test conditions are described in this volume (the first of three volumes). Representative results are also presented and comparisons are made with data from other sources. The complete results for pressure distributions, forces, pitching moments, and boundary-layer separation and reattachment characteristics are available in graphical form in volumes 2 and 3. The results of the experiment show important differences between airfoils, which would otherwise tend to be masked by differences in wind tunnels, particularly in steady cases. All of the airfoils tested provide significant advantages over the conventional NACA 0012 profile. In general, however, the parameters of the unsteady motion appear to be more important than airfoil shape in determining the dynamic-stall airloads

Author

N82-32315*# Douglas Aircraft Co, Inc, Long Beach, Calif
LONG DUCT NACELLE AERODYNAMIC DEVELOPMENT FOR DC-10 DERIVATIVES Final Report

S P Patel and J E Donelson Aug 1980 29 p refs (Contract NAS1-15327) (NASA-CR-159271, NAS 1.26.159271; ACEE-17-FR-9005) Avail NTIS HC A03/MF A01 CSCL 01A

The results are presented of a wind tunnel test utilizing a 4.7-percent-scale semispan model of the DC-10 in the Calspan 8-foot transonic wind tunnel. The effect of a revised long-duct nacelle shape on the channel velocities, the incremental drag relative to the baseline long-duct nacelle, and channel velocities for the baseline long-duct nacelle were determined and compared with data obtained at Ames. The baseline and the revised long-duct nacelles are representative of a CF6-50 mixed-flow configuration and were evaluated on a model of a proposed DC-10 stretched-fuselage configuration. The results showed that the revised long-duct nacelle has an appreciable effect on the inboard channel velocities, resulting in an increased channel Mach number. However, the pressure recovery on the nacelle afterbody was about the same for both nacelles. The lift curves for both long-duct nacelle configurations were the same. The channel pressures measured at Calspan were in good agreement with those measured at Ames for the baseline long-duct nacelle. The incremental drag for the revised nacelle was measured as two to four counts (three counts is approximately equal to one percent of the airplane drag) higher than that of the baseline long-duct nacelle

J M S

N82-32319*# Douglas Aircraft Co, Inc, Long Beach, Calif
INVESTIGATION OF THE INTERFERENCE EFFECTS OF MIXED FLOW LONG DUCT NACELLES ON A DC-10 WING Final Report

S. P. Patel and J. E. Donelson 19 Feb 1982 68 p refs (Contract NAS1-14743) (NASA-CR-159202, NAS 1 26 159202, ACEE-05-FR-9845) Avail: NTIS HC A04/MF A01 CSCL 01A

Wind tunnel test results utilizing a 4.7 percent scale semispan model in the 11 foot transonic wind tunnel are presented. A low drag long duct nacelle installation for the DC-10 jet transport was

developed. A long duct nacelle representative of a CF6-50 mixed flow configuration was investigated on the DC-10-30. The results showed that the long duct nacelle installation located in the same position as the current short duct nacelle and with the current production symmetrical pylon is a relatively low risk installation for the DC-10 aircraft. Tuft observations and analytical boundary layer analysis confirmed that the flow on the nacelle afterbody was attached. A small pylon fairing was evaluated and found to reduce channel peak suction pressures, which resulted in a small drag improvement. The test also confirmed that the optimum nacelle incidence angle is the same as for the short duct nacelle, thus the same engine mount as for the production short duct nacelle can be used for the long duct nacelle installation. Comparison of the inboard wing pylon nacelle channel pressure distributions, with flow through and powered long duct nacelles showed that the power effects did not change the flow mechanism, hence, power effects can be considered negligible

S L

N82-32320*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EFFECT OF NOZZLE AND VERTICAL-TAIL VARIABLES ON THE PERFORMANCE OF A 3-SURFACE F-15 MODEL AT TRANSONIC MACH NUMBERS

Odis C Pendergraft, Jr and E Ann Bare Aug 1982 171 p (NASA-TP-2043, L-15304, NAS 1 60 2043) Avail NTIS HC A08/MF A01 CSCL 01A

An investigation was conducted in the Langley 16 foot transonic tunnel to determine the longitudinal aerodynamic characteristics of twin two dimensional nozzles and twin baseline axisymmetric nozzles installed on a fully metric 0.047 scale model of the F-15 three surface configuration (canards, wing, horizontal tails). The effects on performance of two dimensional nozzle in flight thrust reversing, locations and orientation of the vertical tails, and deflections of the horizontal tails were also determined. Test data were obtained at static conditions and at Mach numbers from 0.60 to 1.20 over an angle of attack range from -2 deg to 15 deg. Nozzle pressure ratio was varied from jet off to about 6.5

Author

N82-32329# National Severe Storms Lab, Norman, Okla
CONSIDERATIONS FOR OPTIMUM SITING OF NEXRAD TO DETECT CONVECTIVE PHENOMENA HAZARDOUS TO TERMINAL AIR NAVIGATION, PART 1 Final Report, Oct. 1980 - Feb. 1982

P R Mahapatra, D S Zrnic, and R J Doviak May 1982 38 p refs

(Contract DTFA01-81-Y-10521) (DOT/FAA/RD-82/56, RT0000) Avail NTIS HC A03/MF A01

The number of aircraft accidents during terminal flight in which weather is the cause or a contributing factor, and the possibility of dedicated and detailed surveillance of hazardous weather in the terminal airspace were studied. Considerations for choosing a site for a next generation weather radar (NEXRAD) installation to fulfill this role in an optimum manner. It is shown that the detection of low level wind shear without precipitation imposes the most severe constraints on NEXRAD siting. Three general siting areas are considered: (1) within the airport area, (2) within the terminal area, but outside the airport area, (3) outside the terminal area. When a single NEXRAD radar must cover all hazardous phenomena over the terminal area, siting within the airport area appears to be the best choice. Under certain conditions, a case exists for siting the NEXRAD outside the terminal area

Author

N82-32330# Lincoln Lab, Mass Inst of Tech, Lexington
L-BAND DME MULTIPATH ENVIRONMENT IN THE MICROWAVE LANDING SYSTEM (MLS) APPROACH AND LANDING REGION

James E Evans 13 Apr 1982 265 p refs (Contracts F19628-80-C-0002, DOT-FA74WAI-461) (FAA-RD-82/19, ATC-116) Avail NTIS HC A12/MF A01

The multipath environment in the approach and landing region represents an important factor in the optimization and ultimate performance of the Microwave Landing System (MLS) Precision Distance Measuring Equipment (DME/P). Various types of multipath

are assessed in the context of the proposed DME/P implementation error characteristics to ascertain the principal challenges. It is shown (analytically and experimentally) that specular reflections from buildings represents a significant challenge, particularly at low altitudes (e.g., category 2 decision height and below) where terrain lobing can cause the effective multipath levels to exceed the effective direct signal level. However, the time delay discrimination capabilities of the proposed DME/P should effectively eliminate the bulk of such multipath. Limited S-band (3 GHz) measurements of diffuse reflections from nominally flat terrain indicated very low levels. However, specular reflections from bare, hilly terrain may present problems in some cases. Author

N82-32331# Federal Aviation Administration, Atlantic City, N J Technical Center

TERMINAL INFORMATION PROCESSING SYSTEM (TIPS) CONSOLIDATED CAB DISPLAY (CCD) COMPARATIVE ANALYSIS
Final Report, Sep. 1979 - 1980

Loni Czekalski Apr 1982 84 p refs

(FAA Proj 219-151-120)

(FAA-CT-81-8) Avail NTIS HC A05/MF A01

The air traffic control (ATC) users requirements are outlined. The Terminal Information Processing System (TIPS) and the consolidated cab display (CCD) were analyzed for ATC requirements, system engineering, conceptual differences and similarities, central processors, software, and central processing system cost. The Federal Aviation Administration (FAA) requests in specification form, vendor responses to the specifications and the recommendation which include flight data management in the CCD System are presented. E A K

N82-32334# Department of Defense, Washington, D C
FEDERAL RADIONAVIGATION PLAN. VOLUME 3: RADIONAVIGATION SYSTEM CHARACTERISTICS Final Report, Jul. 1980 - Feb. 1982

Mar 1982 48 p Prepared jointly with DOT 4 Vol
(AD-A116470, DOD-4650 4-P-3, DOT-TSC-RSPA-81-12-3) Avail NTIS HC A03/MF A01 CSCL 17/7

Volume 3 describes present and planned navigation systems in terms of nine major parameters: signal characteristics, accuracy, availability, coverage, reliability, fix rate, fix dimensions, capacity, and ambiguity. The volume addresses the characteristics, capabilities, and limitations of existing and proposed major radionavigation systems. All of the systems considered are defined in terms of system performance parameters which determine the utilization and limitations of the individual navigation system. GRA

N82-32336# IIT Research Inst., Annapolis, Md
IMPACT OF AN OMNIDIRECTIONAL TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM ON THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM AND THE DISCRETE ADDRESS BEACON SYSTEM Final Report

G Patrick and T Keech Nov 1981 39 p refs
(Contracts F19628-80-C-0042, DOT-FA70WAI-175, AF Proj 649E)
(AD-A116170, ECAC-PR-81-018, DOT/FAA/RD-81/106) Avail NTIS HC A03/MF A01 CSCL 17/7

A computer analysis was conducted to investigate the effect of an omnidirectional version of the Traffic Alert and Collision Avoidance System (TCAS) on the performance of (1) the Air Traffic Control Radar Beacon System (ATCRBS), and (2) the planned Discrete Address Beacon System (DABS) in selected air traffic environments. The performance of ATCRBS and DABS was examined both with and without the TCAS in operation. Additional simulations were conducted to quantify the effect of TCAS when employing its interference-limiting function. Author (GRA)

N82-32337# Elliott-Automation Space and Advanced Military Systems Ltd., Frimley (England)
THE DEVELOPMENT OF TERRAIN FOLLOWING DISPLAYS FOR THE TORNADO AIRCRAFT

G A Ward and J M Davies 1982 20 p Presented at Ergonomics Res Soc Symp, 1982
(Rept-200) Avail NTIS HC A02/MF A01

The development of a display which indicates terrain following equipment performance to the pilot and allows him to watch for external threats, such as towers or electronic countermeasures, is described. Display simulation was used in conjunction with flight tests. Airborne video recording and ground replay equipment refreshed the memory of aircrew to transient display phenomena noticed in flight and provided an analysis and training record. A mathematical model, validated against photographs of in-flight events correlated by time and feature, enabled development approaches to be assessed prior to commitment to flight trials. In addition to exercising display design, the facility enabled sensor related phenomena to be checked out in more detail, e.g. failure cases and warning mechanization were assessed. Author (ESA)

N82-32338# European Space Agency, Paris (France)
ANALYSIS OF TWO AIR TRAFFIC SAMPLES IN THE FRANKFURT/MAIN AIRPORT TERMINAL AREA, AUGUST 4, 1978

Uwe Voelckers, Manfred Schubert, and Albrecht Seyfried May 1982 115 p refs Transl into ENGLISH of "Anal von zwei Verkehrsabläufen im Anflugbereich Frankfurt/Main vom 4. Aug 1978" rept. DFVLR-Mitt-81-12 DFVLR, Brunswick, Jun 1981 127 p

(ESA-TT-739, DFVLR-Mitt-81-12) Avail NTIS HC A06/MF A01, original German version available from DFVLR, Cologne DM 28

In order to investigate traffic flow and ATC strategies under peak load conditions, two surveys were carried out in the approach control area. When a receptive strategy was adopted, i.e., little control exerted over the acceptance rates, a slight reduction in the scatter of the distribution of arrivals at the pickup is noted, compared with a regulative strategy. Fewer holding procedures at the outer stacks, a higher average number of aircraft within the control area and on the extended runway centerline, and the need for holds at the inner stacks also result. The ensuing higher traffic density in the approach control area created difficult initial conditions for sequence planning. Control is affected more by the working techniques of individual controllers than by traffic flow. Author (ESA)

N82-32339# European Space Agency, Paris (France)
ANALYSIS OF TWO AIR TRAFFIC SAMPLES IN THE FRANKFURT/MAIN AIRPORT TERMINAL AREA, AUGUST 3, 1979

Manfred Schubert and Uwe Voelckers Jun 1982 103 p refs Transl into ENGLISH of "Analyse von zwei Verkehrsabläufen im Anflugbereich Frankfurt/Main vom 3. Aug 1979" rept. DFVLR-Mitt-81-17 DFVLR, Brunswick, Jun 1981 117 p

(ESA-TT-740, DFVLR-Mitt-81-17) Avail NTIS HC A06/MF A01, original German version available from DFVLR, Cologne DM 26,50

The effects of ATC strategies on arrival distributions, traffic handling, traffic sequence, and traffic density were analyzed, and compared with an analysis of approach traffic. In both sampling periods, traffic flow planning was mainly regulative, i.e., required delays were obtained in the en route region, by individual control or by holding. No instances of receptive control are reported. Holding was necessary at peak periods because alternatives, e.g., accelerating individual approaches in order to fill gaps, are too difficult to coordinate. Three techniques of movement guidance in controller's first instruction are noted: course planning fixes the shortest possible flight path, extended if necessary; course planning fixes a mean flight path, not adjusted until within the intermediate approach area, or course planning is initially in the form of delays. In the intermediate approach area, adjustments are made by accelerations. Author (ESA)

N82-32341*# Sikorsky Aircraft, Stratford, Conn
RSRA VERTICAL DRAG TEST REPORT

R J Flemming Dec 1981 91 p refs

(Contract NAS2-11058)

(NASA-CR-166399, NAS 1 26 166399, SER-72052) Avail NTIS HC A05/MF A01 CSCL 01C

The Rotor Systems Research Aircraft (RSRA), because of its ability to measure rotor loads, was used to conduct an experiment to determine vertical drag, tail rotor blockage, and thrust augmenta-

tion as affected by ground clearance and flight velocity. The RSRA was flown in the helicopter configuration at speeds from 0 to 15 knots for wheel heights from 5 to 150 feet, and to 60 knots out of ground effect. The vertical drag trends in hover, predicted by theory and shown in model tests, were generally confirmed. The OGE hover vertical drag is 4.0 percent, 1.1 percent greater than predicted. The vertical drag decreases rapidly as wheel height is reduced, and is zero at a wheel height of 6 feet. The vertical drag also decreases with forward speed, approaching zero at sixty knots. The test data show the effect of wheel height and forward speed on thrust, gross weight capability, and power, and provide the relationships for power and collective pitch at constant gross weight required for the simulation of helicopter takeoffs and landings.

Author

N82-32342*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics

AEROELASTIC STABILITY OF ROTOR BLADES USING FINITE ELEMENT ANALYSIS

Inderjit Chopra and Nithia Sivaneri. Aug 1982. 119 p. refs.

(Contract NCC2-13)

(NASA-CR-166389, NAS 1 26 166389) Avail NTIS HC A06/MF A01 CSCL 01C

The flutter stability of flap bending, lead-lag bending, and torsion of helicopter rotor blades in hover is investigated using a finite element formulation based on Hamilton's principle. The blade is divided into a number of finite elements. Quasi-steady strip theory is used to evaluate the aerodynamic loads. The nonlinear equations of motion are solved for steady-state blade deflections through an iterative procedure. The equations of motion are linearized assuming blade motion to be a small perturbation about the steady deflected shape. The normal mode method based on the coupled rotating natural modes is used to reduce the number of equations in the flutter analysis. First the formulation is applied to single-load-path blades (articulated and hingeless blades). Numerical results show very good agreement with existing results obtained using the modal approach. The second part of the application concerns multiple-load-path blades, i.e. bearingless blades. Numerical results are presented for several analytical models of the bearingless blade. Results are also obtained using an equivalent beam approach wherein a bearingless blade is modeled as a single beam with equivalent properties. Results show the equivalent beam model.

Author

N82-32343*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

STATIC INVESTIGATION OF THE CIRCULATION CONTROL WING/UPPER SURFACE BLOWING CONCEPT APPLIED TO THE QUIET SHORT HAUL RESEARCH AIRCRAFT

J. C. Eppel, M. D. Shovlin, D. N. Jaynes, R. J. Englar (Naval Ship Research and Development Center, Bethesda, Md.), and J. H. Nichols, Jr. (Naval Ship Research and Development Center, Bethesda, Md.) Jul 1982. 49 p. refs.

(NASA-TM-84232, A-8883, NAS 1 15 84232) Avail NTIS HC A03/MF A01 CSCL 01C

Full scale static investigations were conducted on the Quiet Short Haul Research Aircraft (QSRA) to determine the thrust deflecting capabilities of the circulation control wing/upper surface blowing (CCW/USB) concept. This scheme, which combines favorable characteristics of both the A-6/CCW and QSRA, employs the flow entrainment properties of CCW to pneumatically deflect engine thrust in lieu of the mechanical USB flap system. Results show that the no moving parts blown system produced static thrust deflections in the range of 40 deg to 97 deg (depending on thrust level) with a CCW pressure of 208,900 Pa (30.3 psig). In addition, the ability to vary horizontal forces from thrust to drag while maintaining a constant vertical (or lift) value was demonstrated by varying the blowing pressure. The versatility of the CCW/USB system, if applied to a STOL aircraft, was confirmed, where rapid conversion from a high drag approach mode to a thrust recovering waveoff or takeoff configuration could be achieved by nearly instantaneous blowing pressure variation.

Author

N82-32344*# Lockheed-Georgia Co., Marietta

MULTIBODY AIRCRAFT STUDY, VOLUME 1 Final Contractor Report, Sep. 1979 - Sep. 1981

J. W. Moore, E. P. Craven, B. T. Farmer, J. F. Honrath, R. E. Stephens, C. E. Bronson, Jr., R. T. Meyer, and J. H. Hogue. Jul 1982. 238 p. refs. 2 Vol.

(Contract NAS1-15927)

(NASA-CR-165829-Vol-1, NAS 1 26 165829-Vol-1, LG81ER0259-Vol-1) Avail NTIS HC A11/MF A01 CSCL 01C

The potential benefits of a multibody aircraft when compared to a single body aircraft are presented. The analyses consist principally of a detailed point design analysis of three multibody and one single body aircraft, based on a selected payload of 350,000 kg (771,618 lb), for final aircraft definitions, sensitivity studies to evaluate the effects of variations in payload, wing semispan body locations, and fuel price, recommendations as to the research and technology requirements needed to validate the multibody concept. Two, two body, one, three body, and one single body aircraft were finalized for the selected payload, with DOC being the prime figure of merit. When compared to the single body, the multibody aircraft showed a reduction in DOC by as much as 11.3 percent. Operating weight was reduced up to 14 percent, and fly away cost reductions ranged from 8.6 to 13.4 percent. Weight reduction, hence cost, of the multibody aircraft resulted primarily from the wing bending relief afforded by the bodies being located outboard on the wing.

Author

N82-32345*# Lockheed-Georgia Co., Marietta

MULTIBODY AIRCRAFT STUDY, VOLUME 2 Contractor Report, Sep. 1979 - Sep. 1981

J. W. Moore, E. P. Craven, B. T. Farmer, J. F. Honrath, R. E. Stephens, C. E. Bronson, Jr., R. T. Meyer, and J. G. Hogue. Dec 1981. 230 p. refs. 2 Vol.

(Contract NAS1-15927)

(NASA-CR-165829-Vol-2, NAS 1 26 165829-Vol-2, LG81ER0259-Vol-2) Avail NTIS HC A10/MF A01 CSCL 01C

The potential benefits of a multibody aircraft when compared to a single body aircraft are presented. The analyses consist principally of a detailed point design analysis of three multibody and one single body aircraft, based on a selected payload of 350,000 kg (771,618 lb), for final aircraft definitions, sensitivity studies to evaluate the effects of variations in payload, wing semispan body locations, and fuel price, recommendations as to the research and technology requirements needed to validate the multibody concept. Two, two body, one, three body, and one single body aircraft were finalized for the selected payload, with DOC being the prime figure of merit. When compared to the single body, the multibody aircraft showed a reduction in DOC by as much as 11.3 percent. Operating weight was reduced up to 14 percent, and fly away cost reductions ranged from 8.6 to 13.4 percent. Weight reduction, hence cost, of the multibody aircraft resulted primarily from the wing bending relief afforded by the bodies being located outboard on the wing.

Author

N82-32346*# Boeing Commercial Airplane Co., Seattle, Wash. **SELECTED ADVANCED AERODYNAMICS AND ACTIVE CONTROLS TECHNOLOGY CONCEPTS DEVELOPMENT ON A DERIVATIVE B-747 Final Report, May 1977 - May 1979**

Washington NASA. Jul 1980. 301 p. refs.

(Contract NAS1-14741)

(NASA-CR-3164, NAS 1 26 3164, D6-48664) Avail NTIS HC A14/MF A01 CSCL 01C

The feasibility of applying wing tip extensions, winglets, and active control wing load alleviation to the Boeing 747 is investigated. Winglet aerodynamic design methods and high speed wind tunnel test results of winglets and of symmetrically deflected ailerons are presented. Structural resizing analyses to determine weight and aeroelastic twist increments for all the concepts and flutter model test results for the wing with winglets are included. Control law development, system mechanization/reliability studies, and aileron balance tab trade studies for active wing load alleviation systems are discussed. Results are presented in the form of incremental effects on L/D, structural weight, block fuel savings,

stability and control, airplane price, and airline operating economics
S L

N82-32347*# Douglas Aircraft Co., Inc., Long Beach, Calif
SELECTED WINGLET AND MIXED FLOW LONG DUCT NACELLE DEVELOPMENT FOR DC-10 DERIVATIVE AIRCRAFT
Final Summary Report

A B Taylor Washington NASA Jun 1980 42 p refs
(NASA-CR-3296, NAS 1 26 3296, ACEE-05-FR-9912) Avail NTIS
HC A03/MF A01 CSCL 01C

The high speed cruise drag effects of the installation of winglets and a wing tip extension and a mixed flow long duct nacelle are investigated. The winglet program utilized a 47 percent semispan model in an eight foot transonic wind tunnel. Winglets provided approximately twice the cruise drag reduction of wing tip extensions for about the same increase in bending moment at the wing-fuselage juncture. The long duct nacelle interference drag program utilized the same model, without the winglets, in the 11 foot transonic wind tunnel. The long duct nacelle, installed in the same position as the current short duct nacelle and with the current production symmetric pylon, was a relatively low risk installation. A pylon with an addition small rearward fairing was also tested and showed some drag reduction potential over the current pylon.
S L

N82-32348*# Douglas Aircraft Co., Inc., Long Beach, Calif
APPLICATION OF AN OPTIMIZED WINGLET CONFIGURATION TO AN ADVANCED COMMERCIAL TRANSPORT

C A Shollenberger Nov 1979 82 p refs Revised
(Contract NAS1-14744)
(NASA-CR-159156, NAS 1 26 159156, ACEE-06-FR-9661-Rev)
Avail NTIS HC A05/MF A01 CSCL 01C

The design is presented of an aircraft which employs an integrated wing and winglet lift system. Comparison was made with a conventional baseline configuration employing a high-aspect-ratio supercritical wing. An optimized wing-winglet combination was selected from four proposed configurations for which aerodynamic, structural, and weight characteristics were evaluated. Each candidate wing-winglet configuration was constrained to the same induced drag coefficient as the baseline aircraft. The selected wing-winglet configuration was resized for a specific medium-range mission requirement, and operating costs were estimated for a typical mission. Study results indicated that the wing-winglet aircraft was lighter and could complete the specified mission at less cost than the conventional wing aircraft. These indications were sensitive to the impact of flutter characteristics and, to a lesser extent, to the performance of the high-lift system. Further study in these areas is recommended to reduce uncertainty in future development.
Author

N82-32349*# Boeing Commercial Airplane Co., Seattle, Wash
PRELIMINARY DESIGN DEPT
INTEGRATED APPLICATION OF ACTIVE CONTROLS (IAAC)
TECHNOLOGY TO AN ADVANCED SUBSONIC TRANSPORT PROJECT. INITIAL ACT CONFIGURATION DESIGN STUDY
Summary Report, Aug. 1978 - Sep. 1979

Washington NASA Oct 1980 40 p refs
(Contracts NAS1-14742, NAS1-15325)
(NASA-CR-3304, NAS 1 26 3304, D6-48671) Avail NTIS
HC A03/MF A01 CSCL 01C

The initial ACT configuration design task of the integrated application of active controls (IAAC) technology project within the Energy Efficient Transport Program is summarized. A constrained application of active controls technology (ACT) resulted in significant improvements over a conventional baseline configuration previously established. The configuration uses the same levels of technology, takeoff gross weight, payload, and design requirements/objectives as the baseline, except for flying qualities, flutter, and ACT. The baseline wing is moved forward 1.68 m. The configuration incorporates pitch-augmented stability (which enabled an approximately 10% aft shift in cruise center of gravity and a 45% reduction in horizontal tail size), lateral/directional-augmented stability, an angle of attack limiter, wing load alleviation, and flutter

mode control. This resulted in a 930 kg reduction in airplane operating empty weight and a 3.6% improvement in cruise efficiency, yielding a 13% range increase. Adjusted to the 3590 km baseline mission range, this amounts to 6% block fuel reduction and a 15.7% higher incremental return on investment, using 1978 dollars and fuel cost.
S L

N82-32350*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va

SOME DESIGN CONSIDERATIONS FOR SOLAR-POWERED AIRCRAFT

William H Phillips Jun 1980 60 p refs
(NASA-TP-1675, L-13562, NAS 1 60 1675) Avail NTIS
HC A04/MF A01 CSCL 01C

Performance and operating characteristics are presented for a solar powered aircraft intended to remain aloft for long periods. The critical technologies which limit the performance are identified. By using the techniques presented, the effects of variation in the system parameters are studied. Practical design consideration are discussed.
S L

N82-32351# Simmonds Precision Products, Inc., Vergennes, Vermont
Instrument Systems Div

COMMERCIAL AIRCRAFT AIRFRAME FUEL SYSTEMS SURVEY AND ANALYSIS Final Report, Oct. 1980 - Jun. 1982

P G Weitz Atlantic City, N.J. FAA Jul 1982 98 p refs
(Contract DTFA03-80-C-0080)
(DOT/FAA/CT-82/80, Rept-181-320-100) Avail NTIS
HC A05/MF A01

A selection of commercial aircraft airframe fuel systems was studied to determine areas where incompatibility with antimisting kerosene fuel (AMK) may exist. Incompatibility can be due to reduced fuel system component performance with AMK or shear degradation of the AMK by the fuel system components. Survey results, to date, indicate that potential component performance problems with AMK are more significant than loss of AMK flammability protection due to shear degradation. Components of interest include ejector pumps, fuel filters, and auxiliary power units.
Author

N82-32352# Operations Research, Inc., Silver Spring, Md
AIRCRAFT ENERGY CONSERVATION DURING AIRPORT GROUND OPERATIONS Final Report

J Bauchspies, F Costello, J Felder, J Thompson, and H Hilliard
Washington FAA Mar 1982 313 p
(Contract DTFA01-80-C-10132)
(AD-A116138, FAA-EE-82-8, ORI-TR-1974) Avail NTIS
HC A14/MF A01 CSCL 01/2

This study identifies and assesses potential fuel conservation options which are available for use during ground operations at Dulles International (IAD) and Washington National (DCA) airports. The study also identifies and analyzes ground operations fuel savings options which have been considered and/or implemented by the various airlines operating at IAD and/or DCA since 1971. In addition, an evaluation of computer models which could be used for analyzing these fuel conservation options at other airports is included. The impact of socio/economic factors such as safety, environment, limitation on expansion and restrictions on accommodating forecast activity at DCA and IAD were considered during the analysis of each option.
Author (GRA)

N82-32354# McDonnell-Douglas Astronautics Co., St. Louis, Mo
AIRBORNE FLIGHT TEST SYSTEM (AFTS) Final Report

John A Maynard 26 Oct 1982 84 p
(Contract F33615-76-C-1002)
(AD-A115100, SD-TR-82-2) Avail NTIS HC A05/MF A01 CSCL
17/2

A full 1000 Mbps laser communications system transmitting from an aircraft to a ground station receiver was demonstrated. The system was designed around spaceborne terminal requirements and included prototype operational components. A spaceborne high data rate transmitter was designed, the space platform design was adapted to operate on a KC-135 aircraft, development

N82-32355

and fabrication of both the ground based receiver terminal, and the airborne transmitter were developed and fabricated GRA

N82-32355# Army Aviation Engineering Flight Activity, Edwards AFB, Calif Directorate of Development and Qualification
CLIMATIC LABORATORY EVALUATION YCH-47D HELICOPTER Final Report, 9 Sep. - 22 Oct. 1980

John R Niemann, Charles F Adam, and Jerry A Brown Aug 1981 222 p refs
(AD-A115861, USAAEFA-79-13) Avail NTIS HC A10/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a climatic laboratory evaluation of the Boeing Vertol YCH-47D helicopter. Approximately 17-1/2 hours of aircraft operating time and 22 test runs were required to complete the test. The YCH-47D systems, subsystems and components were evaluated at stabilized temperatures ranging from -65 F to +125 F. In some cases, inconclusive results were obtained at the colder temperatures because the test was conducted without rotor blades. The foremost of which are the apparent inability of the flight control hydraulic fluid to warm sufficiently for flight and the pilot's inability to neutralize the flight controls prior to engine start. The YCH-47D performed acceptably from -25 F to 125 F and exhibited potential for operation at a temperature of -50 F. Two deficiencies were identified: (1) failure of the engine control lever to control the engine during start because of excess moisture in the cockpit, and (2) the erratic operation of the hydraulic power transfer units at -50 F. A total of 14 shortcomings were also identified. Further engineering testing below -25 F with rotor blades installed is recommended to determine if the hydraulic fluid temperature can be increased and maintained in flight at a level that would provide satisfactory flight control response and to evaluate the use of MIL-H-5606 hydraulic fluid at the lower temperatures. The operator's manual should specify a minimum temperature for aircraft operation. Author (GRA)

N82-32356# Naval Air Development Center, Warminster, Pa
REPLACEMENT OF ABOARD NAVAL AIRCRAFT Progress Report

L C Fuller, K G Clark, and E R Wright 10 Nov 1981 99 p refs
(AD-A115782, NADC-81080-60) Avail NTIS HC A05/MF A01 CSCL 01/3

A program for replacing asbestos on Naval aircraft has been initiated. A survey to identify all asbestos-containing aircraft materials has been made. Many commercially available substitutes and their properties have been identified. Replacements will soon be available for MIL-A-7021 asbestos gasket material.

Author (GRA)

N82-32357# Kuhn (Richard E.), Newport News, Va
HIGH PRESSURE BLEED FOR STOL AND STO-VL PERFORMANCE: A CONCEPTUAL EXAMINATION Final Report

Richard E Kuhn May 1982 54 p refs
(Contract N00167-81-M-3207)
(AD-A115762, DTNSRDC-82/032, DTNSRDC-AERO-1279) Avail NTIS HC A04/MF A01 CSCL 01/2

The engines in modern combat aircraft are sized by combat maneuverability considerations. These aircraft therefore have much more thrust available than is needed at normal takeoff and landing speeds. Only the Harrier, which can vector the thrust of the centrally-mounted engine through the center of gravity can use its excess thrust to reduce the takeoff and landing distance (to zero at low operating weights). The engines on the others are too far aft for direct thrust vectoring. This paper examines other possibilities. The main emphasis is on the possibility of using bleed air from the high pressure compressor to blow the wing and/or a canard for STOL performance. Alternately, the use of this high pressure bleed to drive fold-out fans to achieve STO-VL performance is also examined. Author (GRA)

N82-32359# Aeronautical Research Labs, Melbourne (Australia)
Aerodynamics Div

DATA REDUCTION PROCEDURES FOR SEA KING HELICOPTER FLIGHT TRIALS

N E Gilbert May 1982 58 p refs
(AD-A117044, AERO-TM-338, AR-002-884) Avail NTIS
HC A04/MF A01 CSCL 09/2

The data reduction procedures used in obtaining fully processed data from raw flight data for trials on a Sea King Mk 50 helicopter are given. The procedures allow various corrections and calibrations to be applied, removal of noise, and calculation of many additional quantities, some of which are used for kinematic consistency checking purposes. Examples are provided on the running of the various computer programs developed. To assist in the use of the data for validation of the Sea King mathematical model, output is obtained in a form allowing ready comparison between trials and model results on the same graphs. Author (GRA)

N82-32360# European Space Agency, Paris (France)

AN ANALYTICAL STUDY OF LANDING FLARE

Guenther Knorr and Knut Wilhelm Jun 1982 61 p refs Transl into ENGLISH of "Ein Beitrag zur anal Beschreibung des Abfangvorgangs" rept DFVLR-FB-79-40 DFVLR, Brunswick, Sep 1979 76 p
(ESA-TT-656, DFVLR-FB-79-40) Avail NTIS HC A04/MF A01, original German version available from DFVLR, Cologne DM 15,20

Landing flare is described, taking into account the aircraft eigen dynamics. Analytical solutions are given for the time history of the state variables in flare, using a simple control law. Conventional flare, flare with direct lift control, and flare with coupled control movements of elevator and flap are described. The effect of wind shear is investigated. The solution functions are evaluated taking an airliner as example. A tolerance range for flare initiation is defined. Author (ESA)

N82-32361 Elliott-Automation Space and Advanced Military Systems Ltd, Frimley (England)

AVIONIC SYSTEM DEVELOPMENT FOR THE TORNADO F MK2

P H T Horrox 1981 8 p Presented at Marconi 81 Symp, 23 Jun 1981
(Rept-96) Avail NTIS HC A02

The development of the Air Defence Variant (ADV) avionics system is sketched. The functions of the system design, software, test and trials, system support, and project control teams are outlined. Target sequencing software, an algorithm for combat environment navigation, and a data link which gives users access to targets tracked by other radars are discussed. A test rig in which a real time computer model of the ADV can be flown by a stick and throttle or by a simulation of the autopilot, is described. Author (ESA)

N82-32362*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

DESIGN OF ANALYTICAL FAILURE DETECTION USING SECONDARY OBSERVERS

M Sisar Aug 1982 49 p refs
(NASA-TM-84284, NAS 115 84284) Avail NTIS
HC A03/MF A01 CSCL 01D

The problem of designing analytical failure-detection systems (FDS) for sensors and actuators, using observers, is addressed. The use of observers in FDS is related to the examination of the n-dimensional observer error vector which carries the necessary information on possible failures. The problem is that in practical systems, in which only some of the components of the state vector are measured, one has access only to the m-dimensional observer-output error vector, with $m < \text{or} = n$. In order to cope with these cases, a secondary observer is synthesized to reconstruct the entire observer-error vector from the observer output error vector. This approach leads toward the design of highly sensitive and reliable FDS, with the possibility of obtaining a unique fingerprint for every possible failure. In order to keep the observer's (or Kalman filter) false-alarm rate under a certain specified value, it is necessary to have an acceptable matching

between the observer (or Kalman filter) models and the system parameters. A previously developed adaptive observer algorithm is used to maintain the desired system-observer model matching, despite initial mismatching or system parameter variations. Conditions for convergence for the adaptive process are obtained, leading to a simple adaptive law (algorithm) with the possibility of an a priori choice of fixed adaptive gains. Simulation results show good tracking performance with small observer output errors, while accurate and fast parameter identification, in both deterministic and stochastic cases, is obtained. Author

**N82-32363*# Ohio Univ., Athens Avionics Engineering Center
EFFICIENT TRANSFER OF WEATHER INFORMATION TO THE
PILOT IN FLIGHT Final Summary Report**

Richard H McFarland Hampton, Va NASA Langley Research Center Apr 1982 24 p refs
(Grant NAG1-124)
(NASA-CR-165889, NAS 1 26 165889) Avail NTIS
HC A02/MF A01 CSCL 05H

Efficient methods for providing weather information to the pilot in flight are summarized. Use of discrete communications channels in the aeronautical, VHF band or subcarriers in the VOR navigation band are considered the best possibilities. Data rates can be provided such that inputs to the ground based transmitters from 2400 band telephone lines are easily accommodated together with additional data. The crucial weather data considered for uplinking are identified as radar reflectivity patterns relating to precipitation, sphere data, hourly sequences, nowcasts, forecasts, cloud top heights with freezing and icing conditions, the critical weather map and satellite maps. NEXRAD, the ground based, Doppler weather radar which will produce an improved weather product also encourages use of an uplink to fully utilize its capability to improve air safety. S L

**N82-32364# Technology, Inc., Dayton, Ohio
DEVELOPMENT OF A STRUCTURAL INTEGRITY RECORDING
SYSTEM (SIRS) FOR US ARMY AH-1S HELICOPTERS Final
Report, Aug. 1981 - May 1982**

James G Dotson and Axel W Kolb Fort Eustis, Va Army Research and Technology Labs May 1982 128 p refs
(Contract DAAK51-81-C-0035, DA Proj 1L1-62209-AH-76)
(AD-A116027, USAVRADCOM-TR-82-D-8) Avail NTIS
HC A07/MF A01 CSCL 01/4

A follow-on research and development program to implement a Structural Integrity Recording System (SIRS) for the Army AH-1S helicopter was conducted by developing a computer program to reduce recorded aircraft usage data. The program, titled Fatigue Damage Assessment System (FDAS), was designed to run on the AVRADCOM computer. An improved lift-link-mounted strain sensor was also developed. The sensor was laboratory-tested and deemed ready for follow-on application testing in regard to monitoring helicopter gross weight, and take-off and landing detection. Author (GRA)

**N82-32365# Smiths Industries, Inc., Clearwater, Fla Aerospace
and Defense Systems Div**

**RELIABILITY AND MAINTAINABILITY IMPROVEMENT PRO-
GRAM FOR THE AV-8A/TAV-8A HARRIER HEAD-UP DISPLAY
SET, DEVELOPMENT OF THE SIGNAL DATA CONVERTER,
CV-3600/AVQ-30(V), VOLUME 3 Final Engineering Report**

M D Carmichael 20 Sep 1982 16 p 3 Vol
(Contract N00019-77-A-0350)
(AD-A115554, SI-1010-Vol-3, NADC-78080-60-Vol-3) Avail NTIS
HC A02/MF A01 CSCL 14/2

The circuitry driving the head-up display in the AV-8A aircraft, called the Waveform Generator, was revised and updated to improve reliability. The new unit, called the Signal Data Converter, provides greater capability, built-in test features, phosphor protection circuits, reduced size and weight, and greater adaptability to changed input or output requirements. Author (GRA)

**N82-32366* National Aeronautics and Space Administration Lewis
Research Center, Cleveland, Ohio**

**ACTIVE CLEARANCE CONTROL SYSTEM FOR A TUR-
BOMACHINE Patent**

Richard P Johnston, Malcolm H Knapp, and Charles E Coulson,
inventors (to NASA) Issued 11 May 1982 6 p Filed 25 Jul
1979

(NASA-Case-LEW-12938-1, US-Patent-4,329,114,
US-Patent-Appl-SN-060449, US-Patent-Class-415-145,
US-Patent-Class-415-178, US-Patent-Class-60-726,
US-Patent-Class-60-39 29, US-Patent-Class-60-39 07) Avail US
Patent and Trademark Office CSCL 21E

An axial compressor is provided with a cooling air manifold surrounding a portion of the shroud, and means for bleeding air from the compressor to the manifold for selectively flowing it in a modulating manner axially along the outer side of the stator/shroud to cool and shrink it during steady state operating conditions so as to obtain minimum shroud/rotor clearance conditions. Provision is also made to selectively divert the flow of cooling air from the manifold during transient periods of operation so as to alter the thermal growth or shrink rate of the stator/shroud and result in adequate clearance with the compressor rotor.

Official Gazette of the U S Patent and Trademark Office

**N82-32368*# Systems Control, Inc., Palo Alto, Calif
DEVELOPMENT OF A ROTORCRAFT. PROPULSION DYNAM-
ICS INTERFACE ANALYSIS, VOLUME 1 Final Report**

Russell Hull Aug 1982 147 p refs 2 Vol
(Contract NAS2-10765)
(NASA-CR-166380, NAS 1 26 166380) Avail NTIS
HC A07/MF A01 CSCL 21E

The details of the modeling process and its implementation approach are presented. A generic methodology and model structure for performing coupled propulsion/rotor response analysis that is applicable to a variety of rotorcraft types was developed. A method for parameterizing the model structure to represent a particular rotorcraft is defined. The generic modeling methodology, the development of the propulsion system and the rotor/fuselage models, and the formulation of the resulting coupled rotor/propulsion system model are described. A test case that was developed is described. J D

**N82-32369*# Systems Control, Inc., Palo Alto, Calif
DEVELOPMENT OF A ROTORCRAFT. PROPULSION DYNAM-
ICS INTERFACE ANALYSIS, VOLUME 2 Final Report**

Russell Hull Aug 1982 56 p refs 2 Vol
(Contract NAS2-10765)
(NASA-CR-166381, NAS 1 26 166381) Avail NTIS
HC A04/MF A01 CSCL 21E

A study was conducted to establish a coupled rotor/propulsion analysis that would be applicable to a wide range of rotorcraft systems. The effort included the following tasks: (1) development of a model structure suitable for simulating a wide range of rotorcraft configurations, (2) defined a methodology for parameterizing the model structure to represent a particular rotorcraft, (3) constructing a nonlinear coupled rotor/propulsion model as a test case to use in analyzing coupled system dynamics, and (4) an attempt to develop a mostly linear coupled model derived from the complete nonlinear simulations. Documentation of the computer models developed is presented. J M S

**N82-32370*# Lockheed-Georgia Co., Marietta
ADVANCED TURBOPROP TESTBED SYSTEMS STUDY. VOL-
UME 1: TESTBED PROGRAM OBJECTIVES AND PRIORITIES,
DRIVE SYSTEM AND AIRCRAFT DESIGN STUDIES, EVALUA-
TION AND RECOMMENDATIONS AND WIND TUNNEL TEST
PLANS**

E S Bradley, B H Little, W Warnock, C M Jenness, J M
Wilson, C W Powell, and L Shoaf Cleveland, Ohio NASA
Lewis Research Center Jul 1982 368 p refs 2 Vol
(Contract NAS3-22346)

(NASA-CR-167928-Vol-1, NAS 1 26 167928-Vol-1,
LG81ER0202-Vol-1) Avail NTIS HC A16/MF A01 CSCL 21E

The establishment of propfan technology readiness was determined and candidate drive systems for propfan application were identified. Candidate testbed aircraft were investigated for

testbed aircraft suitability and four aircraft selected as possible propfan testbed vehicles. An evaluation of the four candidates was performed and the Boeing KC-135A and the Gulfstream American Gulfstream II recommended as the most suitable aircraft for test application. Conceptual designs of the two recommended aircraft were performed and cost and schedule data for the entire testbed program were generated. The program total cost was estimated and a wind tunnel program cost and schedule is generated in support of the testbed program. E A K

N82-32372# Office National d'Etudes et de Recherches Aeronautiques, Paris (France)

COMPUTATION OF THREE DIMENSIONAL UNSTEADY NONUNIFORM FLOW IN THE BLADE-FREE ANNULAR CHANNEL OF A TURBOMACHINE

Pierre Bry and Pierre Laval 1982 49 p refs In FRENCH, ENGLISH summary. Report will also be announced as translation (ESA-TT-779)

(ONERA-NT-1982-2, ESA-TT-779) Avail NTIS HC A03/MF A01

A numerical method of solution for three dimensional, inviscid, nonuniform, either sub or supersonic flows is presented. A time splitting explicit difference method (disintegration method) with shorter computing times than an explicit classical finite difference method is used. The results illustrate severe inlet total pressure distortion level with or without swirling inlet flow, particularly the modification of the three dimensional flow pattern in the cylindrical channel due to the effects of inlet swirl and total pressure distortion. Author (ESA)

N82-32373* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

DECOUPLER PYLON: WING/STORE FLUTTER SUPPRESSOR Patent

Wilmer H. Reed, III, inventor (to NASA) Issued 10 Aug 1982 9 p Filed 28 Mar 1980 Supersedes N80-22359 (18 - 13, p 1673)

(NASA-Case-LAR-12468-1, US-Patent-4,343,447, US-Patent-Appl-SN-135057, US-Patent-Class-244-137R, US-Patent-Class-244-118 1, US-Patent-Class-89-1 5G) Avail US Patent and Trademark Office CSCL 01C

A device for suspending a store from a support such as an aircraft wing and more specifically for increasing the flutter speed of an aircraft flying with attached store and reducing the sensitivity of flutter to changes in the pitch inertia and center of gravity location of the store is described. It comprises softspring where the store pitch mode is decoupled from support modes and a low frequency active control mechanism which maintains store alignment. A pneumatic suspension system both isolates the store in pitch and, under conditions of changing mean load, aligns the store with the wing to which it is attached.

Official Gazette of the U S Patent and Trademark Office

N82-32374*# Boeing Vertol Co., Philadelphia, Pa
MATH MODELING FOR HELICOPTER SIMULATION OF LOW SPEED, LOW ALTITUDE AND STEEPLY DESCENDING FLIGHT Final Report, Jun. 1981 - Jun. 1982

Philip F. Sheridan, Carl Robinson, John Shaw, and Fred White Moffett Field, Calif NASA Ames Research Center Jul 1982 70 p refs

(Contract NAS2-10975)

(NASA-CR-166385, NAS 1 26 166385) Avail NTIS HC A04/MF A01 CSCL 01C

A math model was formulated to represent some of the aerodynamic effects of low speed, low altitude, and steeply descending flight. The formulation is intended to be consistent with the single rotor real time simulation model at NASA Ames Research Center. The effect of low speed, low altitude flight on main rotor downwash was obtained by assuming a uniform plus first harmonic inflow model and then by using wind tunnel data in the form of hub loads to solve for the inflow coefficients. The result was a set of tables for steady and first harmonic inflow coefficients as functions of ground proximity, angle of attack, and airspeed. The aerodynamics associated with steep descending

flight in the vortex ring state were modeled by replacing the steady induced downwash derived from momentum theory with an experimentally derived value and by including a thrust fluctuations effect due to vortex shedding. Tables of the induced downwash and the magnitude of the thrust fluctuations were created as functions of angle of attack and airspeed. Author

N82-32375*# Information and Control Systems, Inc., Hampton, Va

ACTIVE FLUTTER SUPPRESSION USING OPTICAL OUTPUT FEEDBACK DIGITAL CONTROLLERS

May 1982 79 p refs

(Contract NAS1-16772)

(NASA-CR-165939, NAS 1 26 165939) Avail NTIS HC A05/MF A01 CSCL 01C

A method for synthesizing digital active flutter suppression controllers using the concept of optimal output feedback is presented. A convergent algorithm is employed to determine constrained control law parameters that minimize an infinite time discrete quadratic performance index. Low order compensator dynamics are included in the control law and the compensator parameters are computed along with the output feedback gain as part of the optimization process. An input noise adjustment procedure is used to improve the stability margins of the digital active flutter controller. Sample rate variation, prefilter pole variation, control structure variation and gain scheduling are discussed. A digital control law which accommodates computation delay can stabilize the wing with reasonable rms performance and adequate stability margins. S L

N82-32376*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

TOWARD A BETTER UNDERSTANDING OF HELICOPTER STABILITY DERIVATIVES

Raymond S. Hansen Aug 1982 26 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif

(NASA-TM-84277, NAS 1 15 84277, AVRADCOM-TR-82-A-12) Avail NTIS HC A03/MF A01 CSCL 01C

An amended six degree of freedom helicopter stability and control derivative model was developed in which body acceleration and control rate derivatives were included in the Taylor series expansion. These additional derivatives were derived from consideration of the effects of the higher order rotor flapping dynamics, which are known to be inadequately represented in the conventional six degree of freedom, quasistatic stability derivative model. The amended model was a substantial improvement over the conventional model, effectively doubling the usable bandwidth and providing a more accurate representation of the short period and cross axis characteristics. Further investigations assessed the applicability of the two stability derivative model structures for flight test parameter identification. Parameters were identified using simulation data generated from a higher order base line model having sixth order rotor tip path plane dynamics. Three lower order models were identified: one using the conventional stability derivative model structure, a second using the amended six degree of freedom model structure, and a third model having eight degrees of freedom that included a simplified rotor tip path plane tilt representation. S L

N82-32377*# Douglas Aircraft Co., Inc., Long Beach, Calif
DEVELOPMENT OF A LOW RISK AUGMENTATION SYSTEM FOR AN ENERGY EFFICIENT TRANSPORT HAVING RELAXED STATIC STABILITY

T. R. Sizlo, R. A. Berg, and D. L. Gilles Dec 1979 352 p refs Revised

(Contract NAS1-14744)

(NASA-CR-159166, NAS 1 26 159166, ACEE-06-FR-9679-Rev) Avail NTIS HC A16/MF A01 CSCL 01C

An augmentation system for a 230 passenger, twin engine aircraft designed with a relaxation of conventional longitudinal static stability was developed. The design criteria are established and candidate augmentation system control laws and hardware

architectures are formulated and evaluated with respect to reliability, flying qualities, and flight path tracking performance. The selected systems are shown to satisfy the interpreted regulatory safety and reliability requirements while maintaining the present DC 10 (study baseline) level of maintainability and reliability for the total flight control system. The impact of certification of the relaxed static stability augmentation concept is also estimated with regard to affected federal regulations, system validation plan, and typical development/installation costs. S L

N82-32378*# Boeing Commercial Airplane Co., Seattle, Wash. Product Assurance Unit

THE B-747 FLIGHT CONTROL SYSTEM MAINTENANCE AND RELIABILITY DATA BASE FOR COST EFFECTIVENESS TRADE-OFF STUDIES Contractor Final Report, Nov. 1978 - Jan. 1980

Aug 1982 200 p refs

(Contract NAS1-15588)

(NASA-CR-159275, NAS 1 26 159275, D6-46353) Avail NTIS HC A09/MF A01 CSCL 01C

Primary and automatic flight controls are combined for a total flight control reliability and maintenance cost data base using information from two previous reports and additional cost data gathered from a major airline. A comparison of the current B-747 flight control system effects on reliability and operating cost with that of a B-747 designed for an active control wing load alleviation system is provided. Author

N82-32379*# Boeing Commercial Airplane Co., Seattle, Wash. **COST AND BENEFITS DESIGN OPTIMIZATION MODEL FOR FAULT TOLERANT FLIGHT CONTROL SYSTEMS Contractor Final Report, Sep. 1980**

J Rose Aug 1982 251 p refs

(Contract NAS1-15506)

(NASA-CR-159281, NAS 1 26 159281, D6-46352) Avail NTIS HC A12/MF A01 CSCL 01C

Requirements and specifications for a method of optimizing the design of fault-tolerant flight control systems are provided. Algorithms that could be used for developing new and modifying existing computer programs are also provided, with recommendations for follow-on work. Author

N82-32380*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept

INTEGRATIVE APPLICATION OF ACTIVE CONTROLS (IAAC) TECHNOLOGY TO AN ADVANCED SUBSONIC TRANSPORT PROJECT. INITIAL ACT CONFIGURATION DESIGN STUDY Final Report, Aug. 1978 - Sep. 1979

Jul 1980 412 p refs

(Contracts NAS1-14742, NAS1-15325)

(NASA-CR-159249, NAS 1 26 159249, D6-48662) Avail NTIS HC A18/MF A01 CSCL 01C

The performance and economic benefits of a constrained application of Active Controls Technology (ACT) are identified, and the approach to airplane design is established for subsequent steps leading to the development of a less constrained final ACT configuration. The active controls configurations are measured against a conventional baseline configuration, a state-of-the-art transport, to determine whether the performance and economic changes resulting from ACT merit proceeding with the project. The technology established by the conventional baseline configuration was held constant except for the addition of ACT. The wing, with the same planform, was moved forward on the initial ACT configuration to move the loading range aft relative to the wing mean aerodynamic chord. Wing trailing-edge surfaces and surface controls also were reconfigured for load alleviation and structural stabilization. J M S

N82-32381*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept

INTEGRATED APPLICATION OF ACTIVE CONTROLS (IAAC) TECHNOLOGY TO AN ADVANCED SUBSONIC TRANSPORT PROJECT. CONVENTIONAL BASELINE CONFIGURATION STUDY Final Report

Jun 1980 230 p refs

(Contracts NAS1-14742, NAS1-15325)

(NASA-CR-159248, NAS 1 26 159248, DE-48666-1) Avail NTIS HC A11/MF A01 CSCL 01C

Characteristics of the U.S. domestic fleet were evaluated to determine the mission characteristics that would have the most impact on U.S. transport fuel use in the future. This resulted in selection of a 197-passenger (plus cargo), about 3710-km (2000 nmi) mission. The existing data base was reviewed and additional analysis was conducted as necessary to complete the technical descriptions. The resulting baseline configuration utilizes a double-lobe, but nearly circular, body with seven-abreast seating. External characteristics feature an 8.71 aspect ratio, 31.5-degree sweep wing, a T-tail empennage, and a dual CF6-6D2, wing-mounted engine arrangement. It provides for 22 LD-2 or 11 LD-3 containers plus bulk cargo in the lower lobe. Passenger/cargo loading, servicing provisions, taxi/takeoff speeds, and field length characteristics are all compatible with accepted airline operations and regulatory provisions. The baseline configuration construction uses conventional aluminum structure except for advanced aluminum alloys and a limited amount of graphite epoxy secondary structure. Modern systems are used, including advanced guidance, navigation, and controls which emphasize application of digital electronics and advanced displays. J M S

N82-32382*# Clemson Univ., SC Dept. of Mathematical Sciences

INTEGRATED AIRFRAME PROPULSION CONTROL Contractor Report, Oct. 1980 - Apr. 1982

Robert E. Fennell and Stephen B. Black Aug 1982 102 p

(Grant NAG1-81)

(NASA-CR-3606, NAS 1 26 3606) Avail NTIS HC A06/MF A01 CSCL 01C

Perturbation equations which describe flight dynamics and engine operation about a given operating point are combined to form an integrated aircraft/propulsion system model. Included in the model are the dependence of aerodynamic coefficients upon atmospheric variables along with the dependence of engine variables upon flight condition and inlet performance. An off-design engine performance model is used to identify interaction parameters in the model. Inclusion of subsystem interaction effects introduces coupling between flight and propulsion variables. To analyze interaction effects on control, consideration is first given to control requirements for separate flight and engine models. For the separate airframe model, feedback control provides substantial improvement in short period damping. For the integrated system, feedback control compensates for the coupling present in the model and provides good overall system stability. However, this feedback control law involves many non-zero gains. Analysis of suboptimal control strategies indicates that performance of the closed loop integrated system can be maintained with a feedback matrix in which the number of non-zero gains is small relative to the number of components in the feedback matrix. Author

N82-32383*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Energy Efficient Engine Component Development and Integration Program

ENERGY EFFICIENT ENGINE: HIGH PRESSURE TURBINE UNCOOLED RIG TECHNOLOGY REPORT

W. B. Gardner Oct 1979 242 p refs

(Contract NAS3-20646)

(NASA-CR-165149, NAS 1 26 165149, PWA-5594-92) Avail NTIS HC A11/MF A01 CSCL 14B

Results obtained from testing five performance builds (three vane cascades and two rotating rigs of the Energy Efficient Engine uncooled rig) have established the uncooled aerodynamic efficiency of the high-pressure turbine at 91.1 percent. This efficiency level was attained by increasing the rim speed and annulus area (AN(2)), and by increasing the turbine reaction level. The increase in AN(2) resulted in a performance improvement of 1.15 percent. At the design point pressure ratio, the increased reaction level rig demonstrated an efficiency of 91.1 percent. The results of this program have verified the aerodynamic design assumptions.

established for the Energy Efficient Engine high-pressure turbine component
Author

N82-32384*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
APPLICATION OF A TRANSONIC SIMILARITY RULE TO CORRECT THE EFFECTS OF SIDEWALL BOUNDARY LAYERS IN TWO-DIMENSIONAL TRANSONIC WIND TUNNELS
M.S. Thesis - George Washington Univ.
William Grier Sewall Aug 1982 91 p refs
(NASA-TM-84847, NAS 1 15 84847) Avail NTIS HC A05/MF A01 CSCL 14B

A transonic similarity rule which accounts for the effects of attached sidewall boundary layers is presented and evaluated by comparison with the characteristics of airfoils tested in a two dimensional transonic tunnel with different sidewall boundary layer thicknesses. The rule appears valid provided the sidewall boundary layer both remains attached in the vicinity of the model and occupies a small enough fraction of the tunnel width to preserve sufficient two dimensionality in the tunnel
S L

N82-32386# Mission Research Corp., Alexandria, Va
A-7 FLIGHT SOFTWARE ANALYSIS Final Report, 8 Aug. 1981 - 28 Feb. 1982

Bruce B Amlicke and Joseph C Fox Feb 1982 62 p refs
(Contract N00014-81-C-2476)
(AD-A116179, MRC/WDC-R-018) Avail NTIS HC A04/MF A01 CSCL 09/2

This document describes the development of Unitless Mathematical Models for on-board flight software. The development is part of the NRL Software Cost Reduction Program. A subset of the equations existing in the operational flight program were examined to determine existing units and basic assumptions. The equations were then redervied in unitless form with clearly stated assumptions, this is the form which is most useful to modular design
Author (GRA)

N82-32388# Naval Air Development Center, Warminster, Pa
USER'S GUIDE FOR THE ROTORCRAFT FLIGHT SIMULATION COMPUTER PROGRAM C81, AGAP80 VERSION, CDC CONVERSION Final Report
B J Gajkowski Mar 1982 28 p refs
(AD-A115801, NADC-81290-60) Avail NTIS HC A03/MF A01 CSCL 14/2

The current version of the Rotorcraft Flight Simulation Program C81, AGAP80, was installed in a CDC converted form on the CDC CYBER 175/CDC 6600 Computer System at NAVAIRDEV-CEN. The problems encountered in validating this CDC conversion, using the TR-80-38A User's Manual sample case as a test case, are described. The program capabilities in the area of Flight Dynamics analysis are repeated as a quick guide to the user in order to maintain continuity with the USAAVRADCOM-TR-80-D-38A User's Manual. This report is not meant to supersede TR-80-D-38-A. An effort is made throughout the description of the program capabilities to provide the user with a description of the inputs required to perform that particular program operation and the output data that resulted. The user is referred to the TR-80-D-38A User's Manual for the information necessary for assembling a complete input data deck and to successfully execute the program. There were two program operation problems identified while running test cases on this CDC conversion of the AGAP80 version. These two were the inability to perform any of the postprocessing operations of GDAP80 and the inability to compute eigenvalues in the rotorcraft stability analysis. The cost of running this program at NAVAIRDEV-CEN to perform a trimmed flight analysis, a rotorcraft stability analysis, and a maneuver simulation is discussed
GRA

N82-32389# Naval Biodynamics Lab., New Orleans, La
ATTRIBUTE REQUIREMENTS FOR A SIMULATED FLIGHT SCENARIO MICROCOMPUTER TEST
Richard H Shannon, Michele Krause, and Richard C Irons Jan 1982 27 p refs
(AD-A115676, NBDL-82R004) Avail NTIS HC A03/MF A01 CSCL 05/9

Eighteen subjects practiced a video game of bombing and air combat maneuvering, Phantoms Fiver, on an APPLE microcomputer for 10 minutes a day for 15 days. The dependent variable was the combined score for number of hits and number of targets. Performance stabilized from Days 8 - 15 with a pooled reliability of .904. Eight reference tests which theoretically measure cognitive, perceptual, quantitative, and motor skills were selected and used as independent variables. Stabilized performance on these tests was observed after a period of practice which was predetermined from previous experimentation. Attributes of the Phantoms Five were isolated using a structured job analytic tool (Position Analysis Questionnaire, PAQ). A principal components analysis of the measures that correlated with the dependent variable resulted in a one factor solution explaining 66 percent of the variance
GRA

N82-32421*# Boeing Commercial Airplane Co., Seattle, Wash
ENVIRONMENTAL EXPOSURE EFFECTS ON COMPOSITE MATERIALS FOR COMMERCIAL AIRCRAFT Quarterly Progress Report

Martin N Gibbons Mar 1982 60 p refs
(Contract NAS1-15148)
(NASA-CR-165981, NAS 1 26 165981, D6-44815-14, QPR-14) Avail NTIS HC A04/MF A01 CSCL 11D

The data base for composite materials' properties as they are affected by the environments encountered in operating conditions, both in flight and at ground terminals is expanded. Absorbed moisture degrades the mechanical properties of graphite/epoxy laminates at elevated temperatures. Since airplane components are frequently exposed to atmospheric moisture, rain, and accumulated water, quantitative data are required to evaluate the amount of fluids absorbed under various environmental conditions and the subsequent effects on material properties. In addition, accelerated laboratory test techniques are developed are reliably capable of predicting long term behavior. An accelerated environmental exposure testing procedure is developed, and experimental results are correlated and compared with analytical results to establish the level of confidence for predicting composite material properties
S L

N82-32422# Scientific Systems, Inc., Cambridge, Mass
DETERMINATION OF MATERIAL PROPERTIES BY LIMITED SCAN X-RAY TOMOGRAPHY Final Technical Report, Sep. 1979 - Jan. 1981

Wolfram Jarisch Wright-Patterson AFB, Ohio AFWAL Sep 1982 138 p refs
(Contract F33615-79-C-5132, AF Proj 2418)
(AD-A116670, AFWAL-TR-81-4050) Avail NTIS HC A07/MF A01 CSCL 20/8

The purpose of this program was to explore methods of increasing the speed of the computed tomography (C/T) inspection process. The report presents an analysis of a translational data collection scheme and compares that to the tradition rotation data taken when used in most C/T machinery
Author (GRA)

N82-32424# Ciba-Geigy Corp., Ardsley, NY Plastics and Additives Div
COMPOSITE REPAIR SYSTEM WITH LONG TERM LATENCY Final Report, 27 Oct. 1980 - 26 Jul. 1981

Jonas Weiss Nov 1981 38 p
(Contract M62269-80-C-0711)
(AD-A116472, NADC-80126) Avail NTIS HC A03/MF A01 CSCL 11/4

Novel latent epoxy hardeners which show promise for the field repair of composite structures of naval aircraft have been developed. At least one hardener is latent with epoxy resins for four to five months and exhibits good moisture resistance. These materials may provide the basis for a prepreg material to be used for the repair of graphite structural composites. Latent hardeners were prepared by reacting primary diamines with phthalic anhydride or phthalimide. These adducts are stable with multifunctional epoxy resins (MY 720 and 0510) at ambient temperatures and cure the resins at 150 deg C (302 deg F). DSC analyses show heats of reaction centered in the 101-120 deg C range, indicating that

complete cures may be achieved at these lower temperatures Initial studies show Tg's to be relatively high (120 to 146 deg C) and temperature/humidity resistance to be good The mechanism of the latency of these materials was explained by analogy with HT 939, a CIBA-GEIGY latent hardener containing diethylenetriamine (DETA) HT 939 is incompatible with the standard epoxy resins, but becomes compatible on heating and reacts GRA

**N82-32425# Villanova Univ , Pa
AEROSTRUCTURE NONDESTRUCTIVE EVALUATION BY
THERMAL FIELD DETECTION, PHASE 1: FUNDAMENTAL
INFORMATION AND BASIC TECHNIQUE DEVELOPMENT**

P V McLaughlin, E V McAssey, V R Emany, D N Koert, and J M Spitzer Lakehurst, NJ Naval Air Engineering Center 25 May 1982 122 p refs
(Contract N68335-79-C-1084)
(AD-A115724, NAEC-92-157) Avail NTIS HC A06/MF A01 CSCL 11/4

Methods of flaw detection in laminated fiber composite aerovehicle structures using infrared radiation detection techniques are described Infrared thermography promises to provide a rapid method of damage detection in large structural surfaces. Two methods are described externally applied thermal field (EATF) flaw detection where surface hot spots due to subsurface flaws are created by heating with a radiant heat source, and stress-generated thermal field (SGTF) flaw detection where 'hot spots' in viscoelastic composites are created at stress concentrations near structural flaws during high frequency, low magnitude cyclic loading Analytical and experimental studies were performed on 8 to 32 ply graphite/epoxy laminates and 8 to 16 ply s2 glass/epoxy laminates containing delaminations and partial through holes to evaluate and develop EATF thermography Results show that the conduction method of heat application is unsatisfactory for NDE purposes, and that a radiant energy source in excess of one solar constant is required for best results GRA

**N82-32467# Climax Molybdenum Co of Michigan, Detroit
CARBURIZED HIGH TEMPERATURE STEELS Final Report,
28 Feb. 1980 - 28 Dec. 1981**

D E Diesburg Watertown, Mass Army Materials and Mechanics Research Center Apr 1981 44 p
(Contract DAAG46-80-C-0018)
(AD-A116559, AMMRC-TR-82-24) Avail NTIS HC A03/MF A01 CSCL 11/6

A detailed fracture toughness evaluation before and after a 1000-hour treatment at 315 C (600 F) of candidate steels for use at elevated temperatures in the carburized condition showed that CBS1000 offered the best combination of toughness and retention of hardness at elevated temperature The toughness of X2(M) and X-53 decreased by about 50% during the 1000-hour treatment while that of CBS1000 changed very little A separate study comparing six experimental steels concluded that a composition similar to that of CBS1000 had the highest impact fracture strength, even higher than that of SAE 9310 Author (GRA)

**N82-32504*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
CHARACTERIZATION OF AN EXPERIMENTAL REFEREE
BROADENED SPECIFICATION (ERBS) AVIATION TURBINE
FUEL AND ERBS FUEL BLENDS**

Gary T Seng Aug 1982 25 p refs
(NASA-TM-82883, E-1260, NAS 115 82883) Avail NTIS HC A02/MF A01 CSCL 21D

Characterization data and comparisons of these data are presented for three individual lots of a research test fuel designated as an Experimental Referee Broadened Specification (ERBS) aviation turbine fuel This research fuel, which is a blend of kerosene and hydrotreated catalytic gas oil, is a representation of a kerojet fuel with broadened properties To lower the hydrogen content of the ERBS fuel, a blending stock, composed of xylene bottoms and hydrotreated catalytic gas oil, was developed and employed to produce two different ERBS fuel blends The ERBS fuel blends and the blending stock were also characterized and

the results for the blends are compared to those of the original ERBS fuel The characterization results indicate that with the exception of the freezing point for ERBS lot 2, which was slightly high, the three lots, produced over a 2 year period, met all general fuel requirements However, although the properties of the fuels were found to be fairly consistent, there were differences in composition Similarly, all major requirements for the ERBS fuel blends were met or closely approached, and the properties of the blended fuels were found to generally reflect those expected for the proportions of ERBS fuel and blending stock used in their production Author

**N82-32512# SRI International Corp , Menlo Park, Calif
ANALYSIS AND ENVIRONMENTAL FATE OF AIR FORCE
DISTILLATE AND HIGH DENSITY FUELS Final Report, Aug.
1980 - Oct. 1981**

J H Smith, J C Harper, and H Jaber Tyndall AFB, Fla Air Force Engineering and Services Center Oct 1981 159 p refs
(Contract F08635-80-C-0122, AF Proj 1900)
(AD-A115949, AFESC/ESL-TR-81-43) Avail NTIS HC A08/MF A01 CSCL 21/4

Five high density fuels (RJ-4, RJ-5, RJ-6, JP-9, and JP-10) and three distillate fuels were analyzed by capillary column gas chromatography (GC) The major components of the distillate fuels were identified by gas chromatography-mass spectrometry (GC-MS) The molecular weight of the isomers of the high density fuel components were also determined, but the structures of only a few components were assigned by comparing the GC retention times with authentic samples The concentration and identity of the major water-soluble fuel components were also identified The volatilization rates of the water-soluble components of JP-4, JP-8, and JP-9 were measured by preparing solutions of the fuel components in water, stirring at three stirring rates, and measuring the rate of decrease of the concentration of each component by GC as a function of time The water-soluble components of JP-4 were photolyzed for 21 days in sunlight in deionized water, natural seawater, and water from a local pond The distribution of the fuel components was estimated, using the method recently proposed by Mackay and Patterson The alkanes should partition almost entirely into the atmosphere, the monoaromatics should be in both the air and water, and the naphthalene should partition into the water and the sediment phases Adsorption of the alkanes and monoaromatics should not be a major environmental fate It is recommended that the rate of dissolution in water and evaporation of the pure fuels be studied in detail because they may be the rate-limiting transport processes GRA

**N82-32518# Purdue Univ , Lafayette, Ind
PERFORMANCE OF SRC II FUELS IN GAS-TURBINE COMBUSTORS.
ALTERNATIVE-FUELS-UTILIZATION PROGRAM**

E H Tong and A M Mellor Dec 1981 115 p refs
(Contract DE-AC02-80CS-50098)
(DE82-010471, DOE/CS-50098/1) Avail NTIS HC A06/MF A01

Jet A, SRCII-Middle Distillate (SRCII-MD), and a 50/50 Jet A/SRCII-MD blend were burned in three different laboratory combustion rigs to study fuel property effects on combustion performance Soot concentration, flame radiation, combustion efficiency and flame stabilization measurements were conducted in test rigs simulating conventional and prechamber geometry gas turbine combustors A special ignition rig was used to study ignition performance SRCII fuel's soot concentrations and flame radiation intensities were higher than those for Jet A Generally the 50/50 blend behaved more like the SRCII-MD than the Jet A in these areas Exhaust plane soot concentrations and average flame radiation intensities were found to correlate with hydrogen content, although the latter showed an equivalence ratio dependence For experimentally determined weak extinction limits and minimum ignition energies, comparisons were made with predictions based on characteristic time models that had been developed and verified for petroleum fuels From this work, compositional fuel properties appeared to have secondary effects on both stabilization and ignition performance Combustion efficiency results indicated higher efficiencies for the SRCII-MD than for the blend

N82-32525

However, this was thought to be due to sampling difficulties caused by the ingestion of liquid fuel into the sampling line DOE

N82-32525# Shock and Vibration Information Center (Defense), Washington, D C

THE SHOCK AND VIBRATION DIGEST, VOLUME 14, NO. 3 Monthly Report

Ronald Eshleman, ed, Judith Nagle-Eshleman, ed, and Milda Z Tamulionis, ed Mar 1982 84 p refs
(AD-A112586) Avail SVIC, Code 5804, Naval Research Lab, Washington, D C 20375 CSCL 20/11

Random wave propagation in solid media is discussed. A literature review of mechanical face seal dynamics is presented, experimental observations and theoretical analyses are summarized. A literature review is also presented on subsynchronous vibration of rotor systems.

N82-32528# Mechanical Technology, Inc., Latham, N Y SUBSYNCHRONOUS VIBRATIONS OF ROTOR SYSTEMS

S B Malanoski. In Shock and Vibration Information Center. The Shock and Vibration Digest, Vol 14, No 3 Mar 1982 p 15-21 refs

Avail SVIC, Code 5804, Naval Research Lab, Washington, D C 20375 CSCL 20/11

Subsynchronous vibration of rotor systems. Experimental and analytical studies cover various mechanisms for this instability that can be introduced by hydrodynamics bearings, high pressure fluid seals, labyrinth seals, and working fluids. Papers on practical experience for stability control are cited. BW

N82-32573# Ohio State Univ., Columbus Electroscience Lab GEODESIC PATHS OF AN ELLIPSOID-MOUNTED ANTENNA

Jeung G Kim, Nan Wang, and C D Chuang Mar 1982 100 p refs

(Contract N00019-81-C-0424)

(AD-A116453, ESL-714215-1) Avail NTIS HC A05/MF A01 CSCL 09/1

In applying the high frequency ray technique (GTD) to the radiation problems of an Ellipsoid-mounted antenna, it is essential to determine the geodesic paths on the surface. An efficient, approximate solution for the geodesic paths on the ellipsoid surface, which in turn can be used to model an aircraft or missile fuselage is studied here. Another elaborate method for the geodesic paths employing the calculus of variations is also presented to show the validity of the approximation solution. Typical ellipsoid geometries were chosen and tested for various antenna locations on those surfaces. Good agreement between both methods within the significant energy region confirms that the geodesic paths are efficiently solved via this numerical approach. Author (GRA)

N82-32580# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering

MODELING OF A TRACKING RADAR IN TERMS OF A NONLINEAR SECOND ORDER PHASE LOCK LOOP M S Thesis

Peter M Cronk Dec 1981 120 p refs

(AD-A115628, AFIT/GE/EE/81D-14)

Avail NTIS HC A06/MF A01 CSCL 17/9

An Amplitude Comparison Monopulse radar is modeled using additive channel and system noise to the received signals. The amplitude of the incoming signal and the angle off boresight are estimated under the Maximum Likelihood Criteria. An ensemble of estimates of the angle off boresight are used to derive probability density functions for the estimate angle off boresight. From these probability density functions, a criteria for predicting break lock is derived. Author (GRA)

N82-32582# Pacific-Sierra Research Corp., Santa Monica, Calif
TRANSVERSE ELECTRIC WAVES FOR VLF/LF COMMUNICATION BETWEEN AIRCRAFT Final Technical Report, Apr. 1980 - Oct. 1981

E C Field, Jr Nov 1981 53 p refs Presented at the NATO-AGARD Electromag Wave Propagation Panel, Brussels,

21-25 Sep 1981

(Contract N00014-80-C-0398, NR Proj 089-156)

(AD-A115834, PSR-1125) Avail NTIS HC A04/MF A01 CSCL 17/2

This report compares the excitation and propagation of VLF/LF transverse electric (TE) and transverse magnetic (TM) long waves in the earth-ionosphere waveguide. It calculates the dependence of TE and TM mode parameters on three factors: (1) ground conductivity, (2) state of the ionosphere, and (3) elevation of terminals above the ground. It also briefly addresses the effects of atmospheric noise and ground-based jammers on the performance of TE links. Results are given for frequencies between 20 and 50 kHz. Only TM signals are efficiently radiated by ground-based transmitters. However, TE signals are strongly excited by nearly horizontal trailing-wire antennas at elevations exceeding 20 kft and, thus, can be important for air-to-air links. Poorly conducting ground heavily degrades TM propagation, but it will not affect TE propagation if the terminals are elevated at least 5000 ft. TE signals are, therefore, better suited than TM signals for air-to-air links that traverse Greenland and much of Canada. For paths over highly conducting ground, TM signals suffer less degradation than TE signals during intense disturbances, for ground conductivities less than about 0001 mhos/m, however, TM signals are more adversely affected. TE signals also provide protection against ground-based jammers under disturbed ionospheric conditions where geomagnetic conversion is slight. Author (GRA)

N82-32600# British Aerospace Aircraft Group, Preston (England) Maths Services

NUMERICAL APPLICATIONS OF THE PHYSICAL OPTICS APPROACH FOR THE CALCULATION OF RADAR CROSS SECTIONS OF CONVEX PERFECT SCATTERERS

P W Reynolds and S Whittle Sep 1981 81 p refs

(BAe-MSN-261) Copyright Avail Issuing Activity

Factors which determine the way in which an aircraft surface should be divided into geometrically simple panels, used in computerized calculation of radar cross sections, are discussed. An algorithm which evaluates the monostatic return from a planar panel was tested. Accuracy depends on panel size, shape and orientation, the length of the projection of the panel in the direction of radiation, and the difference in position between the true surface panel and the approximating plane panel. The computation speed of the computer program allows a structure with 100,000 panels to be processed in 2 min. Author (ESA)

N82-32667*# Boeing Co., Seattle, Wash Aerodynamic Lab SURFACE FLOW VISUALIZATION REQUIREMENTS FOR TESTING IN NTF

Ronald L Bengelink. In NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 31-35 refs

Avail NTIS HC A16/MF A01 CSCL 14B

Surface flow visualization is required to be correlated at all the facilities to allow the following: (1) an understanding of the chordwise and spanwise extent of laminar flow, (2) the change in shock location for various trip configurations, (3) the effectiveness of the chosen boundary layer trip (since its specifications will change as a function of Reynolds number), and (4) a comparison of the separation patterns at the buffet conditions. A requirement to tunnel-to-tunnel correlation testing involving the NTF is pointed out. A specification for a surface flow visualization system to be used in the NTF is defined. Recognition of the special limitations in the NTF including physical and visual accessibility, high operating cost, flow contamination requirements, as well as the need for on-line review of the results to develop the final trip configurations in a timely manner, leads to the listed requirements. E A K

N82-32669*# Maryland Univ., College Park Dept of Aerospace Engineering

A COLOR VIDEO DISPLAY TECHNIQUE FOR FLOW FIELD SURVEYS

Allen E Winkelmann and Chen P Tsao. In NASA Langley

Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 47-58

Avail NTIS HC A16/MF A01 CSCL 14B

Color video display techniques for flow field surveys are presented. The following techniques were examined: traverse device, used for flow field surveys above and behind finite wing models, flow chart of data reduction for color video display technique, location of spanwise survey stations above and behind wing, hot wire data at first three survey stations on fully stalled wing, hot wire data at last three stations behind fully stalled wing, hot wire and pitch probe data, magnitude of velocity, yaw angle, pitch angle, and cross flow direction from 5 tube survey at $X/C = 2.70$ behind fully stalled wing E A K

N82-32671*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
OPERATIONAL FLOW VISUALIZATION TECHNIQUES IN THE LANGLEY UNITARY PLAN WIND TUNNEL
William A Corlett *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 65-73

Avail NTIS HC A16/MF A01 CSCL 14B

The unitary plan wind tunnel (UPWT) uses in daily operation are shown. New ideas for improving the quality of established flow visualization methods are developed and programs on promising new flow visualization techniques are pursued. The unitary plan wind tunnel is a supersonic facility, referred to as a production facility, although the majority of tests are inhouse basic research investigations. The facility has two 4 ft by 4 ft test sections which span a Mach range from 1.5 to 4.6. The cost of operation is about \$10 per minute. Problems are the time required for a flow visualization test setup and investigation costs and the ability to obtain consistently repeatable results. Examples of sublimation, vapor screen, oil flow, minitufts, schlieren, and shadowgraphs taken in UPWT are presented. All tests in UPWT employ one or more of the flow visualization techniques E A K

N82-32672*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
PROPELLER FLOW VISUALIZATION TECHNIQUES
George L Stefko, F J Paulovich, J P Greissing, and E D Walker *In NASA* Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 75-89

Avail NTIS HC A16/MF A01 CSCL 14B

Propeller flow visualization techniques were tested. The actual operating blade shape as it determines the actual propeller performance and noise was established. The ability to photographically determine the advanced propeller blade tip deflections, local flow field conditions, and gain insight into aeroelastic instability is demonstrated. The analytical prediction methods which are being developed can be compared with experimental data. These comparisons contribute to the verification of these improved methods and give improved capability for designing future advanced propellers with enhanced performance and noise characteristics E A K

N82-32673*# X-Aero Co, Mercer Island, Wash
IN-FLIGHT PROPELLER FLOW VISUALIZATION USING FLUORESCENT MINITUFTS

James P Crowder *In NASA* Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 91-95

Avail NTIS HC A16/MF A01

Extension of fluorescent minituft method to in-flight flow visualization on propellers is described. Extremely thin nylon monofilament for the minitufts, is used in a process of attaching them to the test surface with small drops of lacquer-like adhesive, and the use of fluorescence photography for recording the minituft patterns. Using this method, thousands of minitufts can be applied to small, high speed wind tunnel models without affecting the airflow. The minitufts can remain in place throughout a wind tunnel

test, permitting nonintrusive flow visualization data to be acquired at any time E A K

N82-32674*# Aircraft Research Association Ltd, Bedford (England)
SHADOWGRAPH TECHNIQUES IN TRANSONIC TESTS WITH POWERED NACELLES

P G Hutton *In NASA* Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 97-100

Avail NTIS HC A16/MF A01 CSCL 14B

Shadowgraph photography techniques in transonic wind tunnel tests are described. The system was used in tests with powered nacelle rings to visualize the shock wave pattern in the exhaust flow. The technique is also used for installed nacelle tests on a floor mounted half model with a turbine powered fan engine simulator E A K

N82-32676*# Boeing Co, Seattle, Wash Aerodynamic Lab
TRANSONIC APPLICATIONS OF THE WAKE IMAGING SYSTEM

James P Crowder *In NASA* Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 109-115

Avail NTIS HC A16/MF A01 CSCL 14B

The extension of a rapid flow field survey method (wake imaging system) originally developed for low speed wind tunnel operation, to transonic wind tunnel applications is discussed. The advantage of the system, beside the simplicity and low cost of the data acquisition system, is that the probe position data are recorded as an optical image of the actual sensor and thus are unaffected by the inevitable deflections of the probe support. This permits traversing systems which are deliberately flexible and have unusual motions. Two transverse drive systems are described and several typical data images are given M G

N82-32677*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
FLOW VISUALIZATION IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL AND PRELIMINARY PLANS FOR THE NATIONAL TRANSONIC FACILITY
D B Rhodes and S B Jones *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 117-132

Avail NTIS HC A16/MF A01 CSCL 14B

Design problems associated with the integration of flow visualization in cryogenic facilities are discussed. The possible effects from the cryogenic environment (i.e., window distortion due to thermal contraction both in the mounts and in the window material itself and turbulence in the flow due to injected LN2) are examined. The flow visualization techniques studied are schlieren, shadowgraph, moire deflectometry, and holographic interferometry. The test beds for this work are a Langley in-house cryogenic test chamber and the 0.3-Meter Transonic Cryogenic Tunnel M G

N82-32678*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SEEING THROUGH FLOWS IN LANGLEY'S 0.3-METER TRANSONIC CRYOGENIC TUNNEL

W L Snow, A W Burner, and W K Goad *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 133-147

Avail NTIS HC A16/MF A01 CSCL 14B

Viewing problems associated with the measurement of model deformation in cryogenic wind tunnels are discussed. Tests were conducted in the Langley 0.3-Meter Transonic Cryogenic Tunnel to assess viewing capabilities thru the flow field. The effects of condensation and turbulent boundary layers are discussed and a modelling procedure for image degradation is described M G

N82-32681*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
HOLOGRAPHIC INTERFEROMETRY AND TOMOGRAPHY AT

AMES RESEARCH CENTER

George Lee *In* NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 179-191

Avail NTIS HC A16/MF A01 CSCL 14B

A YAG laser holographic interferometer system and reconstruction laboratory for the Ames 2- by 2-Foot Transonic Wind Tunnel are discussed. This system provides dual plate and double pulse holography for quantitative and qualitative measurements, respectively. Interferometric measurements of two-dimensional airfoils and three-dimensional bodies of revolution for a tomography feasibility study were made. The two-dimensional work included supercritical airfoils, an oscillating airfoil undergoing dynamic stall, and a circulation control airfoil. The tomography experiments centered around hemispherical nose and tangent ogive models. In addition, the tomography work covered the development of a Fourier transform code for the retrieval of the three dimensional density distributions from the interferograms. M G

**N82-32682*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va
FLOW FIELD STUDIES USING HOLOGRAPHIC INTERFEROMETRY AT LANGLEY**

A W Burner, W L Snow, William K Goad, V T Helms, and P B Gooderum *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 193-204

Avail NTIS HC A16/MF A01 CSCL 14B

Some of the uses of holographic interferometry at Langley Research Center both for flow visualization and for density field determinations are described and tests in cryogenic flows at the Langley 0.3-Meter Transonic Cryogenic Tunnel are discussed. Experimental and theoretical fringe shift data are compared. M G

**N82-32686*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
STATUS OF LASER ANEMOMETRY IN TURBOMACHINERY RESEARCH AT THE LEWIS RESEARCH CENTER**

Richard G Seasholtz *In* NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 227-234 refs

Avail NTIS HC A16/MF A01 CSCL 14B

Laser anemometer systems were developed for a full-annular turbine stator cascade facility and for a compressor rotor facility, both are ambient temperature axial flow facilities with a 20-inch tip diameter. The optical configurations of the two anemometers are similar single-component fringe-type backscatter systems with a probe volume diameter of 125 microns and length of about 2 mm. Laser anemometer measurements are compared with numerical solutions for a transonic axial flow compressor rotor and a turbine stator cascade. M G

**N82-32688*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
DEVELOPMENT OF A LASER VELOCIMETER FOR A LARGE TRANSONIC WIND TUNNEL**

John P Greissing and Daniel L Whipple *In* NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 243-247

Avail NTIS HC A16/MF A01 CSCL 14B

On a 8 x 6 Foot Supersonic Wind Tunnel a laser velocimeter was utilized in the testing of advanced high speed turbopropellers. The system, using a 15-W argon-ion laser, a 3-beam 2-axis transmitting-receiving optics package, a zoom lens with 1- to 4-m focal lengths, and a 0.4-m corner mirror was initially assembled and tested in the checkout room. During the time the system was located in the checkout area, experience was acquired in the alignment and operation of the system and the data acquisition system and software were developed. By using air jets to simulate tunnel air flow, the system worked quite well. However, problems with beam alignment arose because of reduced atmospheric pressure. Mounting the laser into a vessel maintained at atmo-

spheric pressure with deflectors mounted to the external walls improved operation for about 2 hours before misalignment reoccurred. The system was remounted to the positioning platform in an enclosure that provides both thermal and acoustic isolation.

R J F

**N82-32689*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
SEEDING CONSIDERATIONS FOR AN LV SYSTEM IN A LARGE TRANSONIC WIND TUNNEL**

Robert J Freedman *In* NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 249-252

Avail NTIS HC A16/MF A01 CSCL 14B

When it was decided to use a laser velocimeter to measure the properties of propellers, seeding was a great concern since large particles fail to flow and small ones are too small to be seen. Many methods were tried and weeded out by using a Malvern particle sizer. The most promising ones were tested in the tunnel and the laser velocimeter (LV) measurements compared to theoretical values of velocity as the particle approached a blunt nose body along a stagnation streamline. Data obtained from the LV system were compared with the one dimensional particle lag calculation. This figure showed the theoretical velocity over the blunt nose and a velocity profile for 5 um particles. This indicated the particles were approximately 5 um. The seeding method is shown. The seed was atomized by 2 seeders run with all 12 available atomizer jets on. The atomizer seed traveled from these two seeders through four 1 inch tubes 20 feet long to the plenum chamber where this cluster of tubes injected the seed into the air stream. The tubes were located 60 feet from the model and could be moved only by shutting the tunnel down. Future seeding plans are shown. R J F

**N82-32690*# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
LV MEASUREMENTS WITH AN ADVANCED TURBOPROP**

Harvey E Neumann and J S Serafini *In* NASA Langley Research Center Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 253-256

Avail NTIS HC A16/MF A01 CSCL 14B

Nonintrusive measurements of velocity about a spinner-propeller-nacelle configuration were made at a Mach number of 0.8. A laser velocimeter (LV) specifically developed for these measurements was used to determine the flow field of the advanced swept SR-3 propeller. The data will be used to study the flow and to verify computer prediction codes. The usefulness of the LV data in detecting flow anomalies and to substantiate the data quality was demonstrated. Some typical results are given. Mach number profiles at the entrance of the propeller are compared with theoretical predictions. The LV data is in excellent agreement with the axisymmetric, compressible, inviscid theory (without blades) ahead of the propeller except near the hub. The data indicate blade blockage near the spinner. Blade to blade variations in axial velocity for four radial positions at the propeller exist are also given. The large apparent wake near the hub is associated with the hub choking. The blade to blade variation of axial velocity ahead of a shock within the blade passage is given. R J F

**N82-32693*# National Aeronautics and Space Administration
Langley Research Center, Hampton, Va
APPLICATIONS OF A LASER VELOCIMETER IN THE LANGLEY 4-BY 7-METER TUNNEL**

William L Sellers and Joe W Elliott (Army Structures Lab) *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 283-293 refs

Avail NTIS HC A16/MF A01 CSCL 14B

Applications of a laser velocimeter in the Langley 4 by 7 meter wind tunnel are discussed. The system configuration is described. The data acquisition, the laser velocimeter traversing, and the

particle generating systems are discussed Flow distribution and rotor wake applications are discussed R J F

N82-32696*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
LASER DOPPLER VELOCIMETRY APPLICATION IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL

Luther R Gartrell *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 323-334 refs

Avail NTIS HC A16/MF A01 CSCL 14B

The problems and the potential use of a nonintrusive flow velocity measuring technique in the Langley 0.3 meter, transonic cryogenic tunnel (TCT) were investigated A laser velocimeter (LV) was used It was concluded that free-stream velocity measurements can be successfully made in the Langley 0.3-m TCT using a low-power (15-mW) LV system The measured and calculated mean velocities typically agreed within one percent The overall normalized standard deviation was less than one percent Tunnel vibration and temperature had no detrimental effects on the optical system It is recommended that the LV work should be further investigated for future use in the Langley 0.3-m TCT R J F

N82-32697*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
VELOCITY AND FLOW ANGLE MEASUREMENTS IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL USING A LASER TRANSIT ANEMOMETER

W C Honaker *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 335-342

Avail NTIS HC A16/MF A01 CSCL 14B

The Laser Transit Anemometer (LTA) system is described In the LTA system two parallel laser beams of known separation and cross sectional area are focussed at the same location or plane When a particle in a flow field passes through both beams and the time is recorded for its transit (time of flight), its velocity can be calculated knowing the distance between the beams By rotating the two beams (spots) around a common center and recording the number of valid events (a particle which passes through both spots in the proper sequence) at each angle the flow angle can be determined by curve fitting a predetermined number of angles or points and calculating the peak of what should be a Gaussian curve The best angle or flow angle is defined as the angle at which the maximum number of valid events occurs The LTA system functioned properly although conditions were less than desirable R J F

N82-32698*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SOME NTF LASER VELOCIMETER INSTALLATION AND OPERATION CONSIDERATIONS

W W Hunter, Jr, L R Gartrell, and W C Honaker *In its* Flow Visualization and Laser Velocimetry for Wind Tunnels Sep 1982 p 343-358 refs

Avail NTIS HC A16/MF A01 CSCL 14B

Two velocimeter techniques were considered as potential candidates for achieving the flow field angularity measurements The first was the fringe laser Doppler velocimeter, (LDV) A great deal of experience was obtained with this approach at Langley and the literature is rich with papers describing many experimental applications and system performance details That is, many velocity flow field measurements were conducted with the LDV but not with high resolution precise angularity measurements The second candidate considered was the two-spot laser transit anemometer, (LTA) This approach was not as extensively used as the LDV technique, but literature does contain experimental applications and system performance details Again, a lack of high resolution, high precision angularity measurements is noted for the LTA The results of the study suggested that the LDV and LTA tests and other efforts did not reveal any fundamental problems that would suggest that laser velocimetry is not a viable diagnostic technique for the National Transonic Facility However, there are a number of engineering problems that need to be solved R J F

N82-32733*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

KINEMATIC PRECISION OF GEAR TRAINS

F L Litvin (Illinois Univ at Chicago Circle), R N Goldrich (Illinois Univ at Chicago Circle), John J Coy (AVRADCOM Research and Technology Lab, Cleveland, Ohio), and E V Zaretsky 1982 40 p refs Proposed for presentation at the Winter Ann. Meeting of the ASME, Phoenix, 15-19 Nov. 1982

(NASA-TM-82887, E-1191, NAS 1 15 82887, AVRADCOM-TR-82-C-10) Avail NTIS HC A03/MF A01 CSCL 13I

Kinematic precision is affected by errors which are the result of either intentional adjustments or accidental defects in manufacturing and assembly of gear trains A method for the determination of kinematic precision of gear trains is described The method is based on the exact kinematic relations for the contact point motions of the gear tooth surfaces under the influence of errors An approximate method is also explained Example applications of the general approximate methods are demonstrated for gear trains consisting of involute (spur and helical) gears, circular arc (Wildhaber-Novikov) gears, and spiral bevel gears Gear noise measurements from a helicopter transmission are presented and discussed with relation to the kinematic precision theory S L

N82-32742# Air Force Inst of Tech, Wright-Patterson AFB, Ohio
LABYRINTH SEAL EFFECTS ON ROTOR BEARING SYSTEM STABILITY M.S. Thesis

Anthony John Pavelko May 1982 170 p refs

(AD-A116774, AFIT-NR-82-10T) Avail NTIS HC A08/MF A01 CSCL 13/9

This thesis presents a stability analysis of rotor bearing system operation affected by a single labyrinth seal Labyrinth seals, primarily intended for leakage control in turbines, have been observed to affect rotor stability in high pressure steam turbines A small experimental rotor bearing system, existing in the Mechanical Engineering Department, and a compatible labyrinth seal are the subjects of this analysis Linear analytical models of these rotor bearing and labyrinth seal systems, both isolated and coupled, are developed Labyrinth seal geometry and pressure variations generate various affects on rotor bearing system stability These affects can help develop labyrinth seal design criteria directed toward high pressure turbine stability enhancement Author (GRA)

N82-32858*# Boeing Commercial Airplane Co, Seattle, Wash
 System Technology Staff

INTEGRATED ENERGY MANAGEMENT STUDY. ENERGY EFFICIENT TRANSPORT PROGRAM Contractor Final Report, 10 Aug. 1977 - 7 Jan. 1978

Mar 1979 102 p refs

(Contract NAS1-14742)

(NASA-CR-158980, NAS 1 26 158980, D6-46700) Avail NTIS HC A01/MF A01 CSCL 10B

The Integrated Energy Management (IEM) Study investigated the practicality and feasibility of a closed-loop energy management system for transport aircraft The study involved (1) instrumentation and collection of in-flight data for a United Airlines 727-200 flying 80 revenue flights throughout the United Airlines network, (2) analysis of the in-flight data to select representative city pairs and establish operational procedures employed in flying a reference flight profile, (3) simulation of the reference profile in a fast-time model to verify the model and establish performance values against which to measure IEM benefits, (4) development of IEM algorithms, and (5) assessment of the IEM concept Author

N82-32899*# Southwest Research Inst, San Antonio, Tex
ASSESSMENT OF BURNING CHARACTERISTICS OF AIRCRAFT INTERIOR MATERIALS

A F Grand and A J Valys Apr 1981 203 p refs

(Contract NAS2-10148)

(NASA-CR-166390, NAS 1 26 166390, Rept-01-5584) Avail NTIS HC A10/MF A01 CSCL 01C

The performance of a series of seat cushion design constructions was compared based on their heat and smoke release

N82-33020

characteristics Tests were conducted in a room size calorimeter instrumented for measuring weight loss, rate of heat release, smoke and volatile decomposition products and the cumulative energy release Baseline data were obtained from burn tests conducted on commercial airline salvage sets as a comparison with more advanced seat designs A toxicological assessment of smoke and fire gases involved the exposure of test animals and their biological responses ascertained Relative toxicological hazards of the combustion gases are discussed based on the animal response studies and the analysis of the combustion gases Author

N82-33020* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

AUTOMATED PROCEDURE FOR DEVELOPING HYBRID COMPUTER SIMULATIONS OF TURBOFAN ENGINES. PART 1: GENERAL DESCRIPTION

John R Szuch, Susan M Krosel, and William M Bruton Aug 1982 120 p refs
(NASA-TP-1851, E-779, NAS 1 60 1851) Avail NTIS HC A06/MF A01 CSCL 09B

A systematic, computer-aided, self-documenting methodology for developing hybrid computer simulations of turbofan engines is presented The methodology that is presented makes use of a host program that can run on a large digital computer and a machine-dependent target (hybrid) program The host program performs all the calculations and data manipulations that are needed to transform user-supplied engine design information to a form suitable for the hybrid computer The host program also trims the self-contained engine model to match specified design-point information Part I contains a general discussion of the methodology, describes a test case, and presents comparisons between hybrid simulation and specified engine performance data Part II, a companion document, contains documentation, in the form of computer printouts, for the test case Author

N82-33120* National Aerospace Lab, Amsterdam (Netherlands) Flight Div

IMPLEMENTABLE DIFFERENTIAL EQUATIONS FOR NONLINEAR FILTERING

H A P Blom 17 May 1981 10 p refs Presented at 2nd Symp on Inform Theory in the Benelux, Zoetermeer, Netherlands 21 May 1981

(NLR-MP-81037 U) Avail NTIS HC A02/MF A01

The representation of a stochastic differential equation for the conditional density of the state of a Markov process, observed in white Gaussian noise is considered The problem presented by the physical interpretation of the stochastic differential, as it can not be interpreted in the Wiener sense, is solved by special transformations For finite state Markov processes, the results can be implemented directly, and a specific application for a binary Markov chain is discussed Author (ESA)

N82-33148* Lockheed-Georgia Co, Marietta

A COMPUTER PROGRAM FOR THE PREDICTION OF NEAR FIELD NOISE OF AIRCRAFT IN CRUISING FLIGHT: USER'S GUIDE

J G Tibbetts Jun 1980 142 p refs

(Contract NAS1-14946)

(NASA-CR-159274, NAS 1 26 159274, LG80ER0069) Avail NTIS HC A07/MF A01 CSCL 20A

Detailed instructions for using the near field cruise noise prediction program, a program listing, and a sample case with output are presented The total noise for free field lossless conditions at selected observer locations is obtained by summing the contributions from up to nine acoustic sources These noise sources, selected at the user's option, include the fan/compressor, turbine, core (combustion), jet, shock, and airframe (trailing edge and turbulent boundary layers) The effects of acoustic suppression materials such as engine inlet treatment may also be included in the noise prediction The program is available for use on the NASA/Langley Research Center CDC computer Comparisons of the program predictions with measured data are also

given, and some possible reasons for their lack of agreement presented J D

N82-33149* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

OPERATIONAL EVALUATION OF A PROPELLER TEST STAND IN THE QUIET FLOW FACILITY AT LANGLEY RESEARCH CENTER

P J W Block Sep 1982 41 p

(NASA-TM-84523, L-15435, NAS 1 15 84523) Avail NTIS HC A03/MF A01 CSCL 20A

Operational proof tests of a propeller test stand (PTS) in a quiet flow facility (QFF) are presented The PTS is an experimental test bed for acoustic propeller research in the quiet flow environment of the QFF These proof tests validate thrust and torque predictions, examine the repeatability of measurements on the PTS, and determine the effect of applying artificial roughness to the propeller blades Since a thrusting propeller causes an open jet to contract, the potential flow core was surveyed to examine the magnitude of the contraction These measurements are compared with predicted values The predictions are used to determine operational limitations for testing a given propeller design in the QFF S L

N82-33150* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

MEASUREMENTS OF MEAN STATIC PRESSURE AND FAR FIELD ACOUSTICS OF SHOCK CONTAINING SUPERSONIC JETS

Thomas D Norum and John M Seiner Sep 1982 199 p refs

(NASA-TM-84521, L-15378, NAS 1 15 84521) Avail NTIS HC A09/MF A01 CSCL 20A

The far field acoustic data base generated in studies of broadband shock noise from supersonic jets is presented Both conical and contoured nozzles of exit Mach numbers 1.0, 1.5, and 2.0 were tested using unheated air at pressure ratios ranging from 1.9 to 1.4 Tests were performed both with and without screech suppression tabs Overall sound pressure variations and representative 1/3-octave and narrowband spectra are presented The mean static pressure measured within these jets is also surveyed Author

N82-33151* Wyle Labs, Inc, El Segundo, Calif

EVALUATION OF NOISE CONTROL TECHNOLOGY AND ALTERNATIVE NOISE CERTIFICATION PROCEDURES FOR PROPELLER-DRIVEN SMALL AIRPLANES Final Report

David Brown and Louis C Sutherland Washington FAA May 1982 224 p refs

(Contract DTFA01-80-C-10133)

(AD-A116495, FAA/EE-82-14, WR-82-4) Avail NTIS HC A10/MF A01 CSCL 20/1

This report considers the effectiveness of current noise regulations in Appendix F of FAR Part 36, examines the potential effectiveness of future technology to achieve further noise reduction, and evaluates a number of new concepts for noise certification procedures for propeller-driven small aircraft The latter were based, in part, on results of a flight test program carried out with Cessna Aircraft Company, to evaluate the utility of takeoff noise tests and the possible use of sound exposure level as a suitable metric for noise certification of the subject aircraft The study indicates that existing regulations have been effective in stimulating development of quieter propellers for the existing fleet of propeller-driven small aircraft However, it does not appear economically feasible to achieve more noise reduction in most of this fleet using existing technology with the possible exceptions of some of the two-engine aircraft However, application of future noise reduction technology, primarily for quieter propellers, should allow a reduction in current noise limits by about 6 dB and should reduce levels of the noisiest aircraft in the current fleet by as much as 10 dB A takeoff test is appropriate for all propeller aircraft except those equipped with cruise-optimized fixed-pitch propellers For this test, the current level flyover test appears to represent the noisiest operating condition GRA

N82-33152# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 154

Thomas H Rau May 1982 18 p

(AF Proj 7231)

(AD-A116146, AMRL-TR-75-50-Vol-154) Avail NTIS HC A02/MF A01 CSCL 01/2

The E-4B is a Boeing 747 aircraft modified to serve as the national emergency/HQ Strategic Air Command Airborne Command Post. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported for 24 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, 'USAF Bioenvironmental Noise Data Handbook, Vol 1 Organization, Content and Application', AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Author

N82-33153# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 149: C-9A IN-FLIGHT CREW/PASSENGER NOISE

Thomas H Rau May 1982 28 p ref

(AF Proj 7231)

(AD-A116145, AMRL-TR-75-50-Vol-149) Avail NTIS HC A03/MF A01 CSCL 01/2

The C-9A is a McDonnell Douglas DC-9 series 30 commercial transport modified to perform aeromedical evacuation missions. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported for 56 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. GRA

N82-33154# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 161: A/M32A-86 GENERATOR SET, DIESEL ENGINE DRIVEN

Thomas H Rau May 1982 157 p refs

(AD-A116147, AMRL-TR-75-50-Vol-161) Avail NTIS HC A08/MF A01 CSCL 01/2

The A/M32A-86 generator set is a diesel engine driven source of electrical power used for the starting of aircraft, and for ground maintenance. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at normal rated/loaded conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 36 locations are normalized to standard meteorological conditions and extrapolated from 10 - 1600 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N82-33155# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 162: MD-4MO GENERATOR SET

Thomas H Rau May 1982 18 p refs

(AD-A116148, AMRL-TR-75-50-Vol-162) Avail NTIS HC A02/MF A01 CSCL 01/2

The MD-4MO generator set is an electric motor-driven source of electrical power used primarily for the starting of aircraft, and for ground maintenance. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at a normal rated condition. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference levels, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. GRA

N82-33156# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 163: GPC-28 COMPRESSOR

Thomas H Rau May 1982 53 p refs

(AD-A116149, AMRL-TR-75-50-Vol-163) Avail NTIS HC A04/MF A01 CSCL 01/2

The GPC-28 is a gasoline engine-driven compressor with a 120 volt 60 Hz generator used for general purpose maintenance. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at a normal rated condition. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 36 locations are normalized to standard meteorological conditions and extrapolated from 10 - 1600 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. GRA

N82-33157# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 164: MD-1 HEATER, DUCT TYPE, PORTABLE

Thomas H Rau May 1982 18 p refs

(AD-A116150, AMRL-TR-75-50-Vol-164) Avail NTIS HC A02/MF A01 CSCL 01/2

The MD-1 heater is an electric motor-driven, portable ground heater used primarily for cockpit and cabin temperature control. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at normal rated conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. GRA

N82-33158# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 165: MC-1 HEATER, DUCT TYPE, PORTABLE

Thomas H Rau Jun 1982 53 p ref

(AF Proj 7231)

(AD-A116151, AMRL-TR-75-50-Vol-165) Avail NTIS HC A04/MF A01 CSCL 01/2

The MC-1 heater is a gasoline-motor driven, portable ground heater used primarily for cockpit and cabin temperature control. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at normal rated conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air

Force ear protectors Far-field data measured at 36 locations are normalized to standard meteorological conditions and extrapolated from 10 1600 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source GRA

N82-33159# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 167: MA-3M AIR CONDITIONER

Thomas H Rau Jun 1982 18 p ref

(AF Proj 7231)

(AD-A116152, AMRL-TR-75-50-Vol-167)

Avail NTIS

HC A02/MF A01 CSCL 01/2

The MA-3M is an electric motor-driven air conditioner designed to cool electronic equipment on aircraft during ground maintenance This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating at a normal rated condition Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference levels, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors GRA

N82-33162# PEER Consultants, Inc , Rockville, Md
EXECUTIVE SUMMARY OF SYSTEMS ANALYSIS TO DEVELOP FUTURE CIVIL AIRCRAFT NOISE REDUCTION ALTERNATIVES Final Report

Lilia Abron Robinson Washington FAA May 1982 75 p

(Contract DTFA01-81-Y-10574)

(AD-A116467, FAA-EE-82-3) Avail NTIS HC A04/MF A01 CSCL 01/3

This executive summary contains the results of the study 'System Analysis to Develop Future Civil Aircraft Noise Reduction Alternatives' performed by Wyle Laboratories under contract no DOT-FA77-WA 3900 (July 1980) The original study first developed and examined a set of projected scenarios of U S carrier aircraft fleet compositions for three planning years 1980, 1990, and 2000 (hereinafter referred to as the planning years) An analysis of the costs and benefits of alternative methods of achieving noise reductions around airports was then made, based on information available in 1979 Forecasts may not necessarily represent present (October 1981) situations The study involved six specific technical areas, for which separate volumes were prepared Volume 1 - Aircraft Classification Specification, Volume 2 - Aircraft Certification, Volume 3 - Technology Assessment, Volume 4 - Definition of Flight Path Options, Volume 5 Land Use Options, and Volume VI - Cost/Benefit Analysis Due to the large amount of data collected for the study, the FAA determined that it would not be economically feasible to publish such a voluminous report Author (GRA)

N82-33163# Air Force Medical Center, Wright-Patterson AFB, Ohio Aerospace Medical Research Lab

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 168: MB-3 TESTER, PRESSURIZED CABIN LEAKAGE, AIRCRAFT

Thomas H Rau Jun 1982 18 p

(AF Proj 7231)

(AD-A116153, AMEL-TR-75-50-Vol-168)

Avail NTIS

HC A02/MF A01 CSCL 01/2

The MB-3 Tester is an electric motor-driven cabin leakage tester designed to furnish pressurized air to the aircraft at controlled pressures and temperatures during ground pressurization of aircraft cockpits and pressurized compartments This report provides measured data defining the bioacoustic environments produced by this unit operating at a normal rated/load condition Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors GRA

N82-33164# Dayton Univ , Ohio School of Engineering
SOUND TRANSMISSION THROUGH DUCTS AND AIRCRAFT NOISE PREDICTION, VOLUME 1 Final Report, 15 May 1978 - 15 May 1981

John J Schauer, John T Datko, and Robert W Guyton Wright-Patterson AFB, Ohio AFWAL Jan 1982 55 p refs

(Contract F33615-78-C-2016, AF Proj 3066)

(AD-A115783, UDR-TR-81-118-Vol-1, AFWAL-TR-81-2131-Vol-1)

Avail NTIS HC A04/MF A01 CSCL 20/1

Aircraft engine acoustical lining impedance models, ray acoustics, hydrodynamic modes, and transient analysis of sound propagation in variable area duct studies were applied to aircraft noise prediction The effects of several duct lining configurations in a TF33 P5 and a CFM56 engined KC-135B aircraft were predicted The prediction was based on a model corrected to fit flight noise data and modified by including theoretical duct noise attenuation predictions The transient solution of variable area ducts permitted the prediction of sound propagation in bullet nose inlets for no low and was moderately successful when a potential flow was included with low Mach numbers Volume 1 contains the technical report and analysis Volume 2 contains the user's manuals and listings of the computer codes developed Author (GRA)

N82-33167# Wyle Labs , Inc , El Segundo, Calif
EFFECTS OF FILTER RESPONSE ON ANALYSIS OF AIRCRAFT NOISE DATA Final Report

Louis C Sutherland Washington FAA May 1982 83 p refs

Prepared for Peer Consultants, Inc

(Contract DTFA-81-Y-10574)

(AD-A116458, FAA-EE-82-2, WR-81-59)

Avail NTIS

HC A05/MF A01 CSCL 17/9

This report analyzes the effects of non-ideal filter transmission characteristics upon the measurement, correction, or extrapolation of aircraft noise data The report is based primarily upon, and represents an abbreviated summary of, two previously published, more detailed reports on this topic The basic approach used to correct aircraft spectra for analysis errors due to finite filter sidebands and signal spectrum slopes involves defining same type of approximation to the true spectrum shape of all frequencies The closer this approximation is to the true spectrum slope, the more accurate the correction for filter effects This report reviews several such filter effect correction methods of varying degrees of accuracy Measurements on the ground of noise from aircraft in flight can involve propagation distances of the order of 300 to 2,000 m or more In this case, band levels at high frequencies can be substantially in error, by more than 10 dB, unless filter effects are considered However, it is also shown that while the band levels may be subject to large errors due to filter effects , errors in composite noise levels such as PNL, LA or EPNL will usually be small - less than 1 dB GRA

N82-33168# Aerospace Medical Research Labs , Wright-Patterson AFB, Ohio Biodynamic Environment Branch

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 158: F-106A AIRCRAFT, NEAR AND FAR-FIELD NOISE

Thomas H Rau May 1982 133 p ref

(AF Proj 7231)

(AD-A116930, AMRL-TR-75-50-Vol-158)

Avail NTIS

HC A07/MF A01 CSCL 01/2

The USAF F-106A is a single seat, all-weather fighter/interceptor aircraft powered by a J75-P-17 turbojet engine This report provides measured and extrapolated data defining the bioacoustic environments produced by this aircraft operating on a concrete runway pad for five engine-power conditions Near-field data are reported for five locations in a wide variety of physical and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 75 - 8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source GRA

N82-33172# European Space Agency, Paris (France)
ACOUSTIC SIMILARITY LAWS FOR CENTRIFUGAL FANS
 Wolfgang Neise and Bernd Barsikow Feb 1982 56 p refs
 Transl into ENGLISH OF "Akustische Aehnlichkeitsgesetze bei Radialventilatoren" rept DFVLR-FB-80-36 DFVLR, Berlin, Aug 1980 6 p
 (ESA-TT-712, DFVLR-FB-80-36) Avail NTIS HC A04/MF A01, original German version available from DFVLR, Cologne DM 10,50

Acoustic similarity laws for fans were experimentally verified. Three, dimensionally similar centrifugal fans of 140, 280, and 560 mm impeller diameter were used. The fans were connected to anechoically terminated discharge ducts. It is shown that the influence of the Reynolds number on the radiated sound pressure is negligible within $140,000 < \text{Re} \leq 450,000$, which is the range covered by the measurements. This result is in agreement with earlier studies in which the Reynolds number was varied from 14,000 to 450,000. Experimental results support the conclusion that fan noise data which is taken on model fans can be extrapolated to other dimensionally similar fans of different size for arbitrary fan speeds and working fluids, provided that the operating condition and the measurement position are the same. Author (ESA)

N82-33173# European Space Agency, Paris (France)
NOISE REDUCTION IN CENTRIFUGAL FANS BY THE USE OF LAMBDA/4 RESONATORS

Wolfgang Neise and Gary H. Koopmann (Houston Univ., Tex.) Mar 1982 64 p refs. Transl into ENGLISH of "Geräuschkinderung bei Radialventilatoren durch lambda/4-Resonatoren" rept DFVLR-FB-81-09 DFVLR, Goettingen, West Ger., Mar 1981 52 p

(ESA-TT-723, DFVLR-FB-81-09) Avail NTIS HC A04/MF A01, original German version available from DFVLR, Cologne DM 9,20

Aerodynamic blade passage noise reduction, using a resonator at the cutoff of a centrifugal fan, is described. While preserving the original cutoff geometry, the perforated mouth of the resonator forms the new cutoff. The resonator can be tuned to various frequencies, e.g., the blade passing frequency, via a movable end plug, enabling tone intensity to be reduced by up to 29 dB. Attenuation of a lesser degree occurs within a frequency band around the resonance frequency. The bandwidth of the resonator response is influenced by the porosity of the resonator mouth. Substantial noise reductions are observed in inlet and outlet ducts over a wide range of aerodynamic loading conditions. The volume flow pumped through a given duct system is changed by less than 1% when the resonator is used. Author (ESA)

N82-33280# Naval Training Analysis and Evaluation Group, Orlando, Fla. Training Analysis and Evaluation Group
CHIEF OF NAVAL AIR TRAINING AUTOMATED MANAGEMENT INFORMATION SYSTEM (CAMIS) USERS GUIDE

Thomas O. Peebles and Gary W. Hodak Apr 1982 56 p
 (AD-A115852, TAEG-TR-121) Avail NTIS HC A04/MF A01 CSCL 09/2

An automated method of reporting flight training and resource utilization information is provided. The CAMIS is comprised of 11 programs which (1) record squadron flight data, student performances, availability of assets, (2) maintain historical data, and (3) produce a variety of reports. This report documents and describes the CAMIS as developed to date and provides a guide to operation of the system. Author

N82-33286# European Space Agency, Paris (France)
SCENARIOS OF ECONOMIC DEVELOPMENT WITHIN THE EUROPEAN COMMUNITY UP TO THE YEAR 2000

Hermann Keimel and Alfons Schmitt Feb 1982 177 p refs. Transl into ENGLISH of "Szenarien der wirtschaftlichen Entwicklung der EG bis zum Jahr 2000" rept DFVLR-FB-81-08 DFVLR, Cologne, Feb 1981 173 p
 (ESA-TT-730, DFVLR-FB-81-08) Avail NTIS HC A09/MF A01, original German version available from DFVLR, Cologne DM 28,70

A tendency scenario is projected in order to assess the influence of the European economy on the need for long-distance transportation, i.e., by air. The tendency scenario is supplemented with two additional scenarios which illustrate possible trends in the European Economic Community either towards a technology based economy or towards a service economy. In the technology scenario it is assumed that after a stagnative period of transition, economic growth impetus will result from technological innovations and world trade expansion. The service economy scenario describes a situation of low economic growth paralleled by strong expansion in the service sector. Based on the qualitative characteristics of the scenarios, quantitative forecasts are made on economic structure. Results are used to show the effect of transportation demand for the scenarios on aircraft development feasibility. Author (ESA)

N82-33330*# National Aeronautics and Space Administration
 Langley Research Center, Hampton, Va
LANGLEY TEST HIGHLIGHTS, 1981

Jul 1982 56 p
 (NASA-TM-84519, NAS 1 15 84519) Avail NTIS HC A04/MF A01 CSCL 05A

Significant aircraft tests which were performed are highlighted. The broad range of the research and technology activities. The contributions of this work toward maintaining United States leadership in aeronautics and space research are illustrated. S L

N82-33332*# National Aeronautics and Space Administration, Washington, D C
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT: 1981 ACTIVITIES

1981 92 p refs
 (NASA-TM-84719, NAS 1 15 84719) Avail NTIS HC A05/MF A01 CSCL 05B

Achievements in the aeronautics and space program by function are summarized. Activities in communications, Earth's resources and environment, space science, space transportation, international activities, and aeronautics are included. S L

N82-33334*# National Aeronautics and Space Administration
 Ames Research Center, Moffett Field, Calif
RECENT PROGRESS IN VSTOL TECHNOLOGY

Leonard Roberts (Stanford Univ., Calif.) and Wallace R. Deckert Aug 1982 34 p refs
 (NASA-TM-84238, A-8896, NAS 1 15 84238) Avail NTIS HC A03/MF A01 CSCL 01C

Progress in vertical and short takeoff and landing (V/STOL) aircraft technology, in particular, during the 1970 to 1980 period at Ames Research Center is discussed. Although only two kinds of V/STOL aircraft (the helicopter and the British direct lift Harrier) have achieved operational maturity, understanding of the technology has vastly improved during this 10 year period. To pursue an aggressive R and D program at a reasonable cost, it was decided to conduct extensive large scale testing in wind tunnel and flight simulation facilities, to develop low cost research aircraft using modified airframes or engines, and to involve other agencies and industry contractors in joint technical and funding arrangements. The STOL investigations include exploring STOL performance using the rotating cylinder flap concept, the augmentor wing, upon initiation of the Quiet Short Haul Research Aircraft program, the upper surface blown flap concept. The VTOL investigations were conducted using a tilt rotor aircraft, resulting in the XV-15 tilt rotor research aircraft. Direct jet lift is now being considered for application to future supersonic fighter aircraft. M G

N82-33337# Naval Air Development Center, Warminster, Pa
 Aircraft and Crew Systems Technology Directorate
SURVEY AND UPDATE OF F-14A MISSION PROFILES FOR TF30 ENGINE USAGE Final Report

S. M. Cote 30 Apr 1982 23 p refs
 (W13550000)
 (AD-A116831; NADC-82093-60) Avail NTIS HC A02/MF A01 CSCL 15/5

The mission profiles and maintenance procedures relating to the TF30-P-412 engines have been investigated to find out whether an observed reduction in engine usage was due to different aircraft missions or new flight procedures. A survey of fleet squadron personnel revealed mission profiles are essentially the same, however, fewer air combat engagements and landing practices account for the lower usage. The F-14 role is now more evenly distributed between air combat and intercepts, while the total number of these missions remains constant. A future advanced technology engine in this aircraft is likely to encounter higher usage requirements if there are no throttle cycle restrictions.

Author (GRA)

N82-33338*# Virginia Polytechnic Inst and State Univ, Blacksburg Coll of Engineering
ROLLING FLOW WIND TUNNEL TESTS OF F-18 AIRCRAFT
 Frederick H Lutze Jun 1980 246 p refs
 (Contract NAS1-15080)

(NASA-CR-169344, NAS 1.26 169344) Avail NTIS HC A11/MF A01 CSCL 01A

The lateral directional characteristics of an F-18 aircraft was investigated. Aerodynamic derivatives associated with pure roll rate, or the 'p' derivatives were obtained. The model is described and the procedures used to obtain and correct the data, and a graphical presentation of the results are presented. These results include graphs of the lateral directional static stability derivatives versus angle of attack, and the lateral directional force and moment coefficients versus nondimensional roll rate. Results are presented for several configurations including complete, complete without vertical tails, complete without horizontal tails, fuselage wing and fuselage alone. Each of these configurations was tested with and without wing leading edge extensions. The basic control surfaces were deflected and the results were investigated. S.L.

N82-33339*# Virginia Polytechnic Inst and State Univ, Blacksburg Coll of Engineering
CURVED FLOW WIND TUNNEL TEST OF F-18 AIRCRAFT
 Frederick H Lutze Apr 1980 294 p refs
 (Contract NAS1-15080)

(NASA-CR-169345, NAS 1.26 169345, VPI-Aero-108) Avail NTIS HC A13/MF A01 CSCL 01A

The curved flow capability of a stability wind tunnel was used to investigate the lateral directional characteristics of an F-18 aircraft. The model is described and the procedures used to obtain and correct the data and a graphical presentation of the results are presented. The results include graphs of lateral directional derivatives versus sideslip or static plots, the lateral directional static stability derivatives versus angle of attack, and finally the lateral directional derivatives versus nondimensional yaw rate for different angles of attack and sideslip. Results are presented for several configurations including complete, complete without vertical tails, complete without horizontal tails, fuselage wing and fuselage alone. Each of these were tested with and without wing leading edge extensions. S.L.

N82-33340*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
USER'S MANUAL FOR INTERFACING A LEADING EDGE, VORTEX ROLLUP PROGRAM WITH TWO LINEAR PANEL METHODS

B. M. E deSilva and R T Medan Apr 1979 98 p refs
 (NASA-TM-78584, A-7744, NAS 1.15 78564) Avail NTIS HC A05/MF A01 CSCL 01A

Sufficient instructions are provided for interfacing the Mangler-Smith, leading edge vortex rollup program with a vortex lattice (POTFAN) method and an advanced higher order, singularity linear analysis for computing the vortex effects for simple canard wing combinations. B.W.

N82-33344*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
NASA RESEARCH ON VISCOUS DRAG REDUCTION
 Richard H Petersen and Dal V Maddalon Aug 1982 28 p refs

Presented at the 13th Congr of the Intern Council of the Aeron Sci (ICAS)/AIAA Aircraft Systems and Technol Meeting, Seattle, 22-27 Aug 1982

(NASA-TM-84518, NAS 1.15 84518) Avail NTIS HC A03/MF A01 CSCL 01A

Research on natural laminar flow, laminar flow control by suction, and turbulent drag reduction is discussed. Preliminary results suggest that a significant amount of natural laminar flow can be achieved on small, straight wing airplanes. On larger, swept wing aircraft, laminar flow control by distributed suction is expected to result in significant fuel savings. The area over which laminar flow control is applied depends on tradeoffs involving structural complexity, maintenance, and cost. Several methods of reducing turbulent skin friction by altering the turbulence structure itself have shown promise in exploratory testing. The status of these technologies and the benefits of applying them to future aircraft are reviewed. Author

N82-33345*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FINITE DIFFERENCE MODELING OF ROTOR FLOWS INCLUDING WAKE EFFECTS

F X Caradonna, A Desopper (ONERA, Chatillon, France), and C Tung Aug 1982 29 p refs. Prepared in cooperation with Army Research and Technology Labs, Moffett Field, Calif
 (NASA-TM-84280, A-9032, NAS 1.15 84280, AVRADCOM-TR-82-A-13) Avail NTIS HC A03/MF A01 CSCL 01A

Rotary wing finite difference methods are investigated. The main concern is the specification of boundary conditions to properly account for the effect of the wake on the blade. Examples are given of an approach where wake effects are introduced by specifying an equivalent angle of attack. An alternate approach is also given where discrete vortices are introduced into the finite difference grid. The resulting computations of hovering and high advance ratio cases compare well with experiment. Some consideration is also given to the modeling of low to moderate advance ratio flows. B.W.

N82-33346*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
RECENT APPLICATIONS OF THE TRANSONIC WING ANALYSIS COMPUTER CODE, TWING

N R Subramanian, Terry L Holst, and Scott D Thomas (Informatics General Corp, Palo Alto, Calif) Aug 1982 42 p refs
 (NASA-TM-84283, A-9035, NAS 1.15 84283) Avail NTIS HC A03/MF A01 CSCL 01A

An evaluation of the transonic-wing-analysis computer code TWING is given. TWING utilizes a fully implicit approximate factorization iteration scheme to solve the full potential equation in conservative form. A numerical elliptic-solver grid-generation scheme is used to generate the required finite-difference mesh. Several wing configurations were analyzed, and the limits of applicability of this code was evaluated. Comparisons of computed results were made with available experimental data. Results indicate that the code is robust, accurate (when significant viscous effects are not present), and efficient. TWING generally produces solutions an order of magnitude faster than other conservative full potential codes using successive-line overrelaxation. The present method is applicable to a wide range of isolated wing configurations including high-aspect-ratio transport wings and low-aspect-ratio, high-sweep, fighter configurations. R J F

N82-33347*# Cessna Aircraft Co, Vandalia, Ohio Accessory Div

IMPACT OF ADVANCED PROPELLER TECHNOLOGY ON AIRCRAFT/MISSION CHARACTERISTICS OF SEVERAL GENERAL AVIATION AIRCRAFT Final Report

Ira D Keiter Sep 1982 82 p refs
 (Contract NAS3-21719)
 (NASA-CR-167984, NAS 1.26 167984) Avail NTIS HC A05/MF A01 CSCL 01A

Studies of several General Aviation aircraft indicated that the application of advanced technologies to General Aviation propellers

can reduce fuel consumption in future aircraft by a significant amount. Propeller blade weight reductions achieved through the use of composites, propeller efficiency and noise improvements achieved through the use of advanced concepts and improved propeller analytical design methods result in aircraft with lower operating cost, acquisition cost and gross weight. Author

N82-33348# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
COMPUTATIONAL AERODYNAMICS AND DESIGN
W F Ballhaus, Jr Aug 1982 23 p refs
(NASA-TM-84257, A-8954, NAS 1.15 84257) Avail NTIS
HC A02/MF A02 CSCL 01A

The availability of supercomputers and the ingenuity of computational aerodynamics in design, and prospects for continued advancement are assessed S L

N82-33356# Army Natick Research and Development Command, Mass

DEVELOPMENT OF METHODS FOR ASSESSMENT OF GLIDING PARACHUTE APPLICATIONS

Thomas F Goodrick 18 Jun 1982 14 p refs Presented at the Army Sci Conf, 15-18 Jun. 1982

(AD-A117103) Avail NTIS HC A02/MF A01 CSCL 01/3

In order to assess the possible utility of gliding parachutes, it was necessary to develop a set of methods for predicting behavior of gliding parachutes. The extent of agreement between simulation and flight data indicates that the primary factors included in the longitudinal stability analysis and in the 6DOF simulation are correct. Although the stability analysis predicts only steady-state behavior, it forms the basis required for analysis of dynamic behavior in the body-fixed XZ plane. The agreement seen in descent rate would not be possible with an invalid stability model. Of course, in turning flight during the response immediately following the deflection, other factors such as the assumed spanwise distribution of lift and drag become predominant. The agreement in yaw rate best illustrates correctness of this aspect of the 6DOF model. The mechanics driving motion during a spin are quite difficult to understand, however, the agreement shown in the descent rate indicates that the mass ratios assumed are accurate and further justifies the assumption of spanwise distribution of lift and drag. In further development activities on gliding parachute systems, the 6DOF model will serve to guide exploratory work and will be updated for more accurate application to different canopies and to larger systems. GRA

N82-33357# Army Research and Technology Labs, Fort Eustis, Va Structures Lab

THE AERODYNAMIC INFLUENCES OF ROTOR BLADE TAPER, TWIST, AIRFOILS AND SOLIDITY ON HOVER AND FORWARD FLIGHT PERFORMANCE

Gene J Bingham 18 Jun 1982 14 p refs Presented at the Army Sci Conf, 15-18 Jun 1982

(AD-A117397) Avail NTIS HC A02/MF A01 CSCL 01/3

The study began with the design of an advanced rotor for the UH-1 helicopter. The initial design goal was to reduce hover power required by 8% without degrading forward flight performance. This reduction was to be accomplished with an aircraft gross weight of 8050 pounds while operating at an altitude of 4000 feet and a temperature of 95 deg F. The study indicated that the design goal could be exceeded. Based on this result, models of the baseline and advanced blade have been evaluated in the Langley V/STOL wind tunnel and the analytical study has been extended to other helicopter configurations within the US Army inventory. This paper is to describe the design philosophy applied. The influence of blade planform and twist on rotor performance are considered first for hover and then for forward flight. These influences initially are made independent of airfoil characteristics, after the influences of blade geometry are described, the airfoil requirements are addressed. GRA

N82-33358# RAND Corp, Santa Monica, Calif
REFLECTIONS ON AN F-43 IN FLIGHT EMERGENCY
Benjamin S Lambeth Dec 1981 13 p refs

(AD-A116873, RAND/P-6682) Avail NTIS HC A02/MF A01 CSCL 01/2

This paper summarizes the highlights of an emergency that occurred on 1 May 1981 in an F-4C assigned to the 159th Tactical Fighter Group, Louisiana Air National Guard. The aircraft, in which the author was flying as an observer, sustained structural damage during the course of a severe out-of-control gyration caused by extremely violent uncommanded pitch oscillations during high-speed, low-altitude flight. Following these events, the aircraft was returned to controlled flight and safely landed at NAS New Orleans. The author is a senior staff member of The Rand Corporation specializing in operational matters of concern to the tactical air forces. He was flying in the aircraft that experienced the emergency with the approval of the National Guard Bureau to enhance his appreciation of fighter employment techniques in connection with his work on Rand's Project AIR FORCE research contract. He has written previously on Soviet and Israeli tactical fighter training and is currently engaged in a study of threat issues bearing on USAF fighter force modernization. Although a civilian with no military background, he has flown extensively in numerous types of USAF fighter aircraft and is a licensed FAA Private Pilot. GRA

N82-33359# Rockwell International Corp, Los Angeles, Calif Aircraft Div

INVESTIGATION OF AIRCREW PROTECTION DURING EMERGENCY ESCAPE AT DYNAMIC PRESSURES UP TO 1600 Q Final Report, 19 May 1980 - 22 Feb. 1981

Robert J Cummings Wright-Patterson AFB, Ohio AMRL May 1982 72 p refs

(Contract F33615-80-C-0513, AF Proj 7231)

(AD-A117552, NA-80-871, AFAMRL-TR-81-71) Avail NTIS HC A04/MF A01 CSCL 01/2

A perspective is developed on requirements for applied biomechanical research necessary to support development of new advanced escape capability for negative static stability margin aircraft. Processes which govern potentially injurious energy transfers to and from the ejectee are enumerated. Four escape design approaches are evaluated in terms of energy transfers, protection strategies, and research requirements, including (1) advanced open upright seat, (2) reclined open, (3) partially encapsulated, (4) encapsulated. GRA

N82-33360# Federal Aviation Administration, Atlantic City, NJ Technical Center

EXAMINATION OF AIRCRAFT INTERIOR EMERGENCY LIGHTING IN A POSTCRASH FIRE ENVIRONMENT Final Report, Mar. 1978 - Dec. 1980

James Demaree Jun 1982 53 p refs

(FAA Proj 181-350-320)

(AD-A117629, FAA-CT-82-55) Avail NTIS HC A04/MF A01 CSCL 13/1

This report describes the effectiveness of emergency interior lighting in a wide-body aircraft test fuselage subjected to elevated temperatures and dense smoke generated by an external fuel fire and interior materials fire. Photometric measurements show significant smoke stratification. The dense smoke at the ceiling can reduce the effectiveness of emergency lighting sources in the upper one third of the aircraft cabin in the very early stages of a cabin fire, while temperatures are survivable in the lower two thirds of the cabin. Placing emergency lighting sources at or below the height of the passenger seat armrest can increase the time span over which the lights are effective. Author (GRA)

N82-33361# Dayton Univ, Ohio
DAYTON AIRCRAFT CABIN FIRE MODEL, VERSION 3. VOLUME 1: PHYSICAL DESCRIPTION Final Report, 1 Apr. 1980 - 31 Mar. 1981

Charles D MacArthur Jun 1982 57 p refs 2 Vol

(Contract DOT-FA74WA-3532)

(AD-A117905, UDRI-TR-81-159-Vol-1, FAA-CT-81-69-Vol-1) Avail NTIS HC A04/MF A01 CSCL 01/2

Version 3 of the Dayton Aircraft cabin Fire Model (DACFIR) has been created as a refinement and generalization of earlier

mathematical models for the computer simulation of fire growth in the cabin of a commercial transport airplane. The model uses data from laboratory tests on the cabin furnishing materials and a zone (control volume) representation of the cabin atmosphere to predict the accumulation of heat, smoke, and gases resulting from arbitrary ignition sources specified in the program input. The major improvements included in Version 3 are a revised cabin atmosphere model which allows for multiple compartments and the prescribed entry of exterior fire gases, and an implicit numerical integration technique for the atmosphere equations. Volume I of this report contains a full description of the model's predictions to the results of three full-scale cabin fire tests. Volume II consists of appendices which include a user's guide and listing of the computer code. Author (GRA)

N82-33362# Federal Aviation Administration, Washington, D C Office of Civil Aviation Security
EFFECTIVENESS OF THE CIVIL AVIATION SECURITY PROGRAM Semiannual Report, 1 Jul. - 31 Dec. 1981
12 Apr 1982 42 p
(AD-A117671, DOT/FAA/ACS-82-15) Avail NTIS HC A03/MF A01 CSCL 01/3

The report includes an analysis of the current threat against civil aviation along with information regarding hijacking attempts, security incidents, bomb threats, and passenger screening activity. It also summarizes ongoing activities to assure adequate protection of civil air commerce against hijacking/sabotage and related crimes, and other aspects of the Civil Aviation Security Program. Author (GRA)

N82-33363# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Flight control Div
TERRAIN FOLLOWING/TERRAIN AVOIDANCE SYSTEM CONCEPT DEVELOPMENT

G D Young, Jr., Walter W Harrington, Roger L Overdorf, and Elisha Rachovitsky 1982 8 p refs
Avail NTIS HC A02/MF A01

A proposed system for terrain following/terrain avoidance (TF/TA) is being developed for real time evaluation. The concepts involve a TF/TA and obstacle avoidance sensor suite including digital landmass simulation data base, a feasible directions guidance algorithm which computes an optimized trajectory based on sensor suite information and satisfies aircraft maneuvering constraints, and a control law which provides tracking of the optimal trajectory for a six degree of freedom aircraft. The design approach is being applied to the advanced fighter technology integration AFTI/F-16 aircraft. Initial work in preparing for real time simulation concentrated on the trajectory algorithm and its software implementation. The algorithm was exercised in a TF only mode for comparison against current systems. A R H

N82-33365# Facility Checking Squadron (1866th) (AFCS), Scott AFB, Ill
TRACALS EVALUATION REPORT. SPECIAL REPORT: A PROCEDURE FOR RTT POSITION IMPROVEMENT USING LINEAR REGRESSION ANALYSIS OF GLIDE SLOPE STRUCTURE Final Report
Harvey J Leister 30 May 1982 70 p
(AD-A115926, Rept-82/66S-277) Avail NTIS HC A04/MF A01 CSCL 17/7

This report presents a method to improve the position of a Radio Telemetry Theodolite (RTT) through an analysis by linear regression of the observed glide path structure of an instrument landing system. A complete derivation of the procedure is also presented, including examples testing the procedure at different glide slope facilities. These tests validated the procedure as well as revealed the limitations of its use. The procedure may be used to establish a permanent optimum RTT location for future use when commissioning new glide slope facilities exhibiting marginal performance and/or requiring Category II operation. Author (GRA)

N82-33366# Flight Safety Foundation, Inc., Arlington, Va
A SAFETY APPRAISAL OF THE AIR TRAFFIC CONTROL SYSTEM

John H Enders 29 Jan 1982 77 p refs
(Contract DTFA01-81-C-10109)
(AD-A115743, FSF-ATC-1142-1-82U) Avail NTIS HC A05/MF A01 CSCL 17/7

In August 1981, the FAA Administrator, Lynn Helms, requested the Flight Safety Foundation to evaluate the safety of the U S Air Traffic Control system during the period following the August 3 strike to air traffic controllers. The evaluation was to provide the Administrator with an independent and objective appraisal of the strengths and weaknesses of the existing air traffic control system during the period of approximately late-August to mid December 1981, and to inform the Administrator of the findings of this appraisal as the developed. Presented in the following pages are the results of this 120-day appraisal conducted by the Flight Safety Foundation. Factors examined pertained to safety, management, fatigue, morale, and rehiring. GRA

N82-33367# Federal Aviation Administration, Atlantic City, N J Technical Center
NORTHEAST CORRIDOR HELICOPTER AREA NAVIGATION ACCURACY EVALUATION Data Report, Jul. 1979 - Apr. 1980
Jack D Edmonds Jun 1982 36 p refs
(FAA Proj 045-330-130)
(AD-A117445, FAA-CT-82-57) Avail NTIS HC A03/MF A01 CSCL 01/2

This report presents area reduced navigation accuracy test flight data collected along an experimental area navigation route structure - the so-called Northeast Corridor. This corridor is an experimental helicopter airway structure extending between Washington, D C, and Boston, Mass. It contains of 2 one-way, reduced width (4 nautical miles (nm)) airways including one route spur from Allentown, Pa. These flight tests were a joint effort of the Federal Aviation Administration and the Helicopter Association International (HAI). The objective was to determine if the NEC could be navigated within the 4-nm airway boundary at the 95 percent confidence level required by Advisory Circular (AC) 90-45A, "Approval of Area Navigation Systems for Use in the U S National Airspace System". GRA

N82-33368# Federal Aviation Administration, Washington, D C Systems Research and Development Service
STUDY OF THE FREQUENCY ASSIGNMENT CONGESTION IN THE ULTRA HIGH FREQUENCY AIR TRAFFIC CONTROL AIR/GROUND COMMUNICATION BAND Final Report
Charles W Cram Apr 1982 32 p refs
(AD-A117640, DOT/FAA/RD-82/29) Avail NTIS HC A03/MF A01 CSCL 17/7

To provide air traffic control of military aircraft operating in the National Airspace System, the Federal Aviation Administration (FAA) makes use of frequencies in the 225 - 400 MHz (UHF) band which is normally administered by the Department of Defense. In 1970 the Military Communications and Electronics Board (MCEB) announced their intention to implement 25 kHz channel spacing in the UHF band. In 1976, the MCEB published an implementation plan which allotted 274 channels for use by the FAA for air traffic control. The purpose of the following study is to determine if the 274 channels made available will be sufficient to satisfy existing and future communication requirements for air traffic control of military aircraft. The study will also show how much additional spectrum support would be required if the 274 channels allotted are not sufficient and possible geographic areas where this additional support would be most necessary. GRA

N82-33369# Federal Aviation Administration, Washington, D C Office Systems Engineering Management
PRELIMINARY ANALYSIS OF THE BENEFITS AND COSTS TO IMPLEMENT THE NATIONAL AIRSPACE SYSTEM PLAN
S M Horowitz and S B Portzky Jun 1982 62 p
(AD-A117664, FAA-EM-82-22) Avail NTIS HC A04/MF A01 CSCL 17/7

The many individual programs which comprise the National Airspace System Plan are designed to provide more air traffic control service to the aviation users at reduced operating costs to

the FAA. The FAA is able to justify its investment in the NAS Plan by a cost/effectiveness argument. The benefits and costs to the aviation users are the focus of this report. By using example cases to quantify a portion of the potential dollar benefits that would be available to the aviation user as a result of the FAA's implementation of its NAS Plan, this report concludes that the added benefits to the users exceed the users' added costs in avionics equipment by a large margin. Author (GRA)

N82-33370# Federal Aviation Administration, Atlantic City, NJ
IMPROVING CONFLICT ALERT PERFORMANCE USING MOVING TARGET DETECTOR DATA Final Report, Oct. 1979 - Sep. 1980

Robert E. Lefferts Jun 1982 85 p refs
 (AD-A117691; FAA-CT-81-17, FAA-RD-81-47) Avail NTIS HC A05/MF A01 CSCL 17/9

The feasibility of using measurements of aircraft radial velocity to improve the performance of the en route tracking algorithm in the present computational environment was examined. Radial velocity can be measured with equipment which is part of the Moving Target Detector (MTD) radar, a new type of search radar. Particular attention is paid in this report to the utilization of radial velocity in reducing speed and heading biases that occur during maneuvers. The performance of the tracking and Conflict Alert algorithms is evaluated on five maneuver detection/observation methods, including the present method. Using both standard and track-oriented parameters yields a total of ten different analyses. A simplified simulation program produces quantitative data. Because the computational resources available for tracking algorithm modifications are limited, consideration of possible applications of radial velocity measurements is restricted to simple algorithm changes. Two aspects of performance are measured: the warning time to a hazardous situation, and the nuisance alert area, a recently developed measure of the false alarm performance of the algorithms. It was concluded that the use of the radial velocity data was not justified in the present systems given the limited computer resources available. The practicality of using radial velocity data in the more extensive system of the future is briefly considered. Author (GRA)

N82-33371# Federal Aviation Administration, Washington, D C
 Office of Management Systems

FAA AIR TRAFFIC ACTIVITY, FY 1981

Patricia Carter and Nancy Trembley 30 Sep 1981 234 p
 (PB82-200361, AMS-220) Avail NTIS HC A11/MF A01 CSCL 17G

Terminal and enroute air traffic activity information of the national airspace system is furnished. The data was reported by the airport traffic control towers, air route traffic control centers, flight service stations, combined station towers, international flight service stations, and approach control facilities. GRA

N82-33372# National Aeronautics and Space Administration
 Langley Research Center, Hampton, Va
FAMILY OF AIRFOIL SHAPES FOR ROTATING BLADES Patent Application

Kevin W. Noonan, inventor (to NASA) Filed 25 Jun 1982 23 p
 (NASA-Case-LAR-12843-1, US-Patent-Appl-SN-392096) Avail NTIS HC A02/MF A01 CSCL 01C

A rotor blade used primarily for a helicopter which has airfoil sections and an overall configuration of a particular shape is described. The upper surface of the airfoil section is shaped such that there is a general reduction in the surface slope from the leading edge to the maximum ordinate at approximately 35% chord. Behind the termination of positive slope, the upper surface slope is negative and decreases continuously to a position of about 70% chord, at which point the surface slope increases continuously to the trailing edge. From the point the lower surface leading edge falls into the lower surface, the lower surface slope is negative and increases continuously to approximately the 44% chord. The lower surface slope is positive and increases continuously to about the 65% chord, aft of which the positive slope decreases continuously to about the 75% chord. The positive slope then

increases continuously from 75% chord to the airfoil trailing edge. The rotor airfoil is shaped to maintain desired values of pitching moment coefficient over a wide range of lift coefficients and increase the drag divergence Mach number, resulting in increased power efficiency and blade stability. NASA

N82-33373# Molusis (John A.), Ashford, Conn
ROTORCRAFT BLADE MODE DAMPING IDENTIFICATION FROM RANDOM RESPONSES USING A RECURSIVE MAXIMUM LIKELIHOOD ALGORITHM Final Report

John A. Molusis Sep 1982 49 p refs
 (NASA Order L-26971-B)
 (NASA-CR-3600, NAS 1 26 3600) Avail NTIS HC A03/MF A01 CSCL 01C

An on line technique is presented for the identification of rotor blade modal damping and frequency from rotorcraft random response test data. The identification technique is based upon a recursive maximum likelihood (RML) algorithm, which is demonstrated to have excellent convergence characteristics in the presence of random measurement noise and random excitation. The RML technique requires virtually no user interaction, provides accurate confidence bands on the parameter estimates, and can be used for continuous monitoring of modal damping during wind tunnel or flight testing. Results are presented from simulation random response data which quantify the identified parameter convergence behavior for various levels of random excitation. The data length required for acceptable parameter accuracy is shown to depend upon the amplitude of random response and the modal damping level. Random response amplitudes of 1.25 degrees to 0.5 degrees are investigated. The RML technique is applied to hingeless rotor test data. The inplane lag regressing mode is identified at different rotor speeds. The identification from the test data is compared with the simulation results and with other available estimates of frequency and damping. S L

N82-33374# Washington Univ., St. Louis, Mo Dept of Mechanical Engineering

DESIGN OF HELICOPTER ROTOR BLADES FOR OPTIMUM DYNAMIC CHARACTERISTICS Semiannual Status Report, 18 Jan. - 16 Jul. 1982

David A. Peters, Timothy Ko, Alfred E. Korn, and Mark P. Rossow 15 Sep 1982 33 p refs. Prepared in cooperation with Univ of Southern Illinois, Edwardsville
 (Grant NAG1-250)

(NASA-CR-169352, NAS 1 26 169352, SASR-1) Avail NTIS HC A03/MF A01 CSCL 01C

The possibilities and the limitations of tailoring blade mass and stiffness distributions to give an optimum blade design in terms of weight, inertia, and dynamic characteristics are investigated. Changes in mass or stiffness distribution used to place rotor frequencies at desired locations are determined. Theoretical limits to the amount of frequency shift are established. Realistic constraints on blade properties based on weight, mass moment of inertia size, strength, and stability are formulated. The extent hub loads can be minimized by proper choice of EL distribution is determined. Configurations that are simple enough to yield clear, fundamental insights into the structural mechanisms but which are sufficiently complex to result in a realistic result for an optimum rotor blade are emphasized. S L

N82-33375# Douglas Aircraft Co., Inc., Long Beach, Calif
ADVANCED TURBOPROP TESTBED SYSTEMS STUDY Final Report

I. M. Goldsmith Jul 1982 255 p refs
 (Contract NAS3-22347)
 (NASA-CR-167895, NAS 1 26 167895, ACEE-22-FR-1699A) Avail NTIS HC A12/MF A01 CSCL 01C

The proof of concept, feasibility, and verification of the advanced prop fan and of the integrated advanced prop fan aircraft are established. The use of existing hardware is compatible with having a successfully expedited testbed ready for flight. A prop fan testbed aircraft is definitely feasible and necessary for verification of prop fan/prop fan aircraft integrity. The Allison T701

is most suitable as a propulsor and modification of existing engine and propeller controls are adequate for the testbed. The airframer is considered the logical overall systems integrator of the testbed program S L

N82-33378# Arinc Research Corp., Annapolis, Md
RELIABILITY, AVAILABILITY, MAINTAINABILITY DATA TRACKING PLAN IMPROVED GUARDRAIL 3
S Jones, R Foote, and H Riser Jun 1982 49 p refs
(Contract DAA07-78-A-6606)
(AD-A117933, Rept-1599-01-2-2711) Avail NTIS
HC A03/MF A01 CSCL 01/3

The objective of the IGRV RAM Tracking Plan is to provide continuous visibility of fielded equipment RAM performance to permit the PM SEMA to determine failure patterns, identify the necessity for in-depth engineering investigations, and assess the desirability of pursuing RAM improvement measures. The plan is designed to be consistent with the requirements contained in the Reliability, Availability, Maintainability Program Plan for Improved GUARDRAIL V. This IGRV RAM Tracking Plan defines the responsibilities, procedures, resources, and schedules necessary to develop, implement, and maintain a RAM audit trail during the life of the system. Author (GRA)

N82-33379# Systems Planning Corp., Arlington, Va
ALTERNATIVE EMPLOYMENT CONCEPTS FOR REMOTELY PILOTTED VEHICLE (RPV) FLIR/TV MISSION PAYLOAD Final Report
W G Howard, W K Evans, and S Shrier Dec 1981 70 p refs
(Contract DAAK50-80-C-0011)
(AD-A117877, SPC-774) Avail NTIS HC A04/MF A01 CSCL 01/3

This study compared the operational potential of the RPV organization in a division that has rear area launch and recovery with that in a division that had independent sections. The study found that rear area launch and recovery could provide significant operational advantages including a smaller basic load of air vehicles, more expeditious resupply of air vehicles, and reduced vulnerability of the ground systems. Reliable communications are required to make the rear area launch and recovery concept effective. Author (GRA)

N82-33380# Army Armament Research and Development Command, Dover, N J Technical Support Directorate
UNIVERSAL TURRET SYSTEM MODEL DETERMINATION AND CONTROLLER PERFORMANCE TESTING Final Report, Oct. 1980 - May 1981
G A Strahl and R A Peterson Apr 1982 73 p refs
(AD-A117687, AD-E400809, ARTSD-TR-81005) Avail NTIS
HC A04/MF A01 CSCL 19/5

Objectives of the testing were to obtain necessary data to determine a valid mathematical model for a universal turret system and to test the performance of optimal turret controllers designed and built for the UTS using that model. Two distinct test phases were conducted: the model determination and the controller performance testing. First, the model determination testing is reported, including turret preparation, test plan preparation and modification, and test execution. Then, the optimal controller design and performance testing is covered. Results of both firing and nonfiring tests are reported and analyzed. The frequency response (Bode) plots are compared to derived theoretical results. The UTS optimal controller performance is compared to the performance of the UTS original controller and of the prototype XM97 controllers tested in a previous program by the use of statistical analysis technique. GRA

N82-33381*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN OPERATIONAL EVALUATION OF HEAD UP DISPLAYS FOR CIVIL TRANSPORT OPERATIONS. NASA/FAA PHASE 3 REPORT Final Report
J K Lauber, R S Bray, R L Harrison, J C Hemingway, and B C Scott (FAA) Aug 1982 198 p refs

(NASA-TP-1815, A-8477, NAS 1 60 1815, HUD-16) Avail NTIS
HC A09/MF A01 CSCL 01D

The advantages and disadvantages of head-up displays (HUDs) in commercial jet transport approach and landing operations was evaluated. Ten airline captains currently qualified in the B-727 aircraft flew a series of instrument landing system (ILS) and nonprecision approaches in a motion base simulator using both a flight director HUD concept and a flightpath HUD concept as well as conventional head-down instruments under a variety of environmental and operational conditions to assess (1) the potential benefits of these HUDs in airline operations, (2) problems which might be associated with their use, and (3) flight crew training requirements and flight crew operating procedures suitable for use with the HUDs. Results are presented in terms of objective simulator based performance measures, subject pilot opinion and rating data, and observer data. Author

N82-33382# Naval Air Development Center, Warminster, Pa
Aircraft and Crew Systems Technology Directorate
THE AIDS/F-18 DIFFRACTIVE HUD Interim Report, 1 Oct. 1978 - 31 Mar. 1982
Harold Green 1 Jun 1982 26 p refs
(AD-A116026, NADC-82147-60) Avail NTIS HC A03/MF A01
CSCL 01/3

The Human Factors Engineering Division (HFE) of the Aircraft and Crew Systems Technology Directorate (ACSTD) at the Naval Air Development Center (NADC) is currently engaged in the evaluation of a diffractive optics Head-Up Display (HUD). This Advanced Integrated Display System (AIDS) HUD employs a state-of-the-art diffraction-optic or holographic combiner, and represents the first such system configured for use in a high performance Naval aircraft (F/A-18). The Hughes Aircraft Co. (HAC) of El Segundo, Cal., under the technical direction of HFE at NADC, has developed the AIDS HUD in a three year incremental effort commencing October 1978. The HUD equipment delivered under Contract N62269-78-C-0232 consisted of one pilot's display unit (PDU), a spare holographic combiner, and a spare CRT/deflection yoke. GRA

N82-33383# Army Avionics Research and Development Activity, Fort Monmouth, N J
VOICE INTERACTIVE SYSTEMS TECHNOLOGY AVIONICS (VISTA) PROGRAM
Lockwood W Reed 18 Jun 1982 10 p Presented at the Army Sci Conf., 15-18 Jun 1982
(AD-A117288) Avail NTIS HC A02/MF A01 CSCL 17/2

Although the preliminary test results are encouraging, it must be remembered that they were taken under ideal conditions. For all testing, the microphone was positioned just brushing the test subject's lips, however, a test was run with one test subject placing the microphone approximately four millimeters from the test subject's lips. The test results showed a 50% decrease in recognition accuracy for the same conditions as those with a microphone touching lips. Although the results are preliminary, it is apparent that the signal-to-noise ratio is a key factor in recognition accuracy. Another problem arises because of the automatic gain controls (AGC) found in most aircraft intercom systems. When there is no voicing for a period of time, the AGC increases the intercom sensitivity. If the first utterance spoken is intended for the recognizer it will likely be rejected because of the distortion caused by the AGC adjusting the gain during the utterance. This is demonstrated in the test results of all test subjects. No attempt was made to set the AGC before beginning the test, as a result, 90% of the first utterances were rejected which resulted in the lowering of the accuracy score by approximately 4%. The AGC has a release time of 10 seconds and the prompts are issued every second, therefore, after the first utterance the AGC has little effect. Some side tests were performed by making an utterance before signaling the computer to begin the test, and in each case the accuracy of the first test word increased to a point comparable to the other vocabulary words. GRA

N82-33384# Arinc Research Corp., Annapolis, Md
DEVELOPMENT OF AVIONICS INSTALLATION INTERFACE

STANDARDS Final Report, 1 Jun - 31 Dec. 1981

C N D Smith, Neil Sullivan, and Atso Savisaar Dec 1981 167 p refs

(Grant F04606-79-G-0082)

(AD-A116853, Rept-2258-21-3-2595)

Avail NTIS

HC A08/MF A01 CSCL 01/3

This report summarizes ARINC Research Corporation's efforts under Air Force Contract F04606-79-G-0082, Delivery Order S706, 'Standard Rack-Mounted and Panel-Mounted Avionics Interface Concepts Analysis'. The period of performance was 1 June 1981 through 31 December 1981. The technical areas addressed were the analysis and specification of rack-mounted avionics, cockpit-mounted control panels, and panel-mounted instruments. Contract tasks included the following: Distribute the draft Packaging, Mounting, and Environment (PME) Standards and other 'working papers' to our mailing list of interested and potential attendees at the open forum, Arrange and conduct a second open forum, Address issues remaining after the second open forum and develop work plans to resolve them, and Continue the development of the PME specification for high-density/high-dissipation avionics packaging. Author (GRA)

**N82-33385# Systems Control, Inc., Palo Alto, Calif
ENHANCEMENTS AND ALGORITHMS FOR AVIONIC INFORMATION PROCESSING SYSTEM DESIGN METHODOLOGY Final Report**

K Doty, A Lemoine, and P McEntire 16 Jun 1982 125 p refs (Contract N62269-81-C-0477)

(AD-A117948, NADC-81105-50) Avail NTIS HC A06/MF A01 CSCL 09/2

This report continues the study of both the software allocation and hardware configuration aspects of avionic information processing systems. The previously developed spatial dynamic programming algorithm is enhanced by incorporating task precedence constraints and hardware failures. Stochastic network methods are used to analyze allocations in the presence of random fluctuations. Graph theoretic methods are used to analyze hardware designs, and new designs are constructed with better values of important parameters, such as the graph diameter. Author (GRA)

N82-33386# General Electric Co., Binghamton, N.Y. Aircraft Equipment Div

NON-COMPLEX ITEM DEVELOPMENT SPECIFICATION FOR A FEASIBILITY MODEL OF AN ELECTRONIC MASTER MONITOR AND ADVISORY DISPLAY SYSTEM (EMMADS) Interim Report, Jun. 1979 - Jun. 1981

Jun 1981 112 p

(Contract DAAK80-79-C-0270, DA Proj 1L2-62202-AH-85)

(AD-A117919, ACS-12, Rept-383, USAAVRADCOM-TR-79-0270-4, IR-4) Avail NTIS HC A06/MF A01 CSCL 01/3

This report is a specification establishing the requirements, quality assurance provisions, and necessary delivery preparations for a feasibility model of an Electronic Master Monitor and Advisory Display System for a CH-47C helicopter. Author (GRA)

N82-33387# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab

SPEECH COMMAND AUDITORY DISPLAY SYSTEM (SCADS) James W Voorhees, Kristine M. Marchionda, and Valerie L. Atchison 18 Jun 1982 9 p Presented at the Army Sci Conf., 15-18 Jun 1982

(AD-A117486) Avail NTIS HC A02/MF A01 CSCL 01/3

The missions of the helicopter, within both the military and the civil sector, have changed rather dramatically over the last 20 years. The military's experience is Southeast Asia during the 1960's demonstrated the wide range of missions that could be accomplished by rotary wing aircraft: fire fighting, heavy lift, and large scale medical evacuations, as well as tactical missions of troop transport and close air support. The post-Vietnam civilian uses for helicopters have duplicated several of the military missions, resulting in an added interest in helicopters in both the military and the civilian sectors. This increased interest has also led to rapid advances in rotorcraft technology. As helicopters have become much more capable, there has been an increasing

sophistication in flight controls, power plant systems, and in cockpit displays. This combination of the increase of types of missions and the increase in cockpit sophistication has created a new set of problems. The limiting factor for many types of helicopter missions is now the pilot, and the limitation appears to be specifically related to information transfer. This information transfer is in the form of aircraft status information to the pilot, and information transfer from the pilot back to the aircraft in the form of control manipulations. Author (GRA)

**N82-33388# Boeing Commercial Airplane Co., Seattle, Wash
AIRCRAFT ALERTING SYSTEMS STANDARDIZATION STUDY. PHASE 4: ACCIDENT IMPLICATIONS ON SYSTEMS DESIGN Final Report, Jul. 1981 - Jun. 1982**

D C Hanson, W W Howison, S F Chikos, and B L Berson Jun 1982 121 p refs Prepared in cooperation with Lockheed Aircraft Co., Burbank, Calif and McDonnell Douglas Corp., St Louis, Mo

(Contract DOT-FA79WA-4268)

(AD-A117876, D6-51464, DOT/FAA/RD-82/26) Avail NTIS HC A06/MF A01 CSCL 01/4

This study, the fourth in a series having evolved from a study of independent altitude monitor requirements and alerting system criteria, has developed a set of substantiated guidelines for the design of aircraft alerting systems. In the course of this work, the FAA concluded that a system which went beyond the function of an alerting system might be useful. The study was extended to examine the question as to whether a system could function as a monitor of flight safety, a system that could aid the pilots in resolving problems and contribute to reducing the number of future accidents. The study established the feasibility of the concept of complementing the alerting system with a computer to perform the flight phase status monitor function. Author (GRA)

**N82-33389# National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio
ROTOR TIP CLEARANCE EFFECTS ON OVERALL AND BLADE-ELEMENT PERFORMANCE OF AXIAL-FLOW TRANSONIC FAN STAGE**

Royce D Moore Sep 1982 87 p refs

(NASA-TP-2049, E-559, NAS 1 60 2049) Avail NTIS HC A05/MF A01 CSCL 21E

The effects of tip clearance on the overall and blade-element performance of an axial-flow transonic fan stage are presented. The 50-centimeter-diameter fan was tested at four tip clearances (nonrotating) from 0.061 to 0.178 centimeter. The calculated radial growth of the blades was 0.040 centimeter at design conditions. The decrease in overall stage performance with increasing clearance is attributed to the loss in rotor performance. For the rotor the effects of clearance on performance parameters extended to about 70 percent of blade span from the tip. The stage still margin based on an assumed operating line decreased from 15.3 to 0 percent as the clearance increased from 0.061 to 0.178 centimeter. Author

N82-33390# Akron Univ., Ohio Dept of Mechanical and Civil Engineering

ENGINE DYNAMIC ANALYSIS WITH GENERAL NONLINEAR FINITE ELEMENT CODES. PART 2: BEARING ELEMENT IMPLEMENTATION OVERALL NUMERICAL CHARACTERISTICS AND BENCHMARKING

J Padovan, M Adams, J Fertis, I Zeid, and P Lam Oct 1982 229 p refs

(Grant NSG-3283)

(NASA-CR-167944, NAS 1 26 167944) Avail NTIS HC A11/MF A01 CSCL 21E

Finite element codes are used in modeling rotor-bearing-stator structure common to the turbine industry. Engine dynamic simulation is used by developing strategies which enable the use of available finite element codes benchmarking the elements developed are benchmarked by incorporation into a general purpose code (ADINA), the numerical characteristics of finite element type rotor-bearing-stator simulations are evaluated through the use of various types of explicit/implicit numerical integration

operators Improving the overall numerical efficiency of the procedure is improved SL

N82-33391*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div
STRUCTURAL TAILORING OF ENGINE BLADES (STAEBL) Interim Report

C E Platt, T K Pratt, and K W Brown Jun 1982 359 p refs (Contract NAS3-22525)
(NASA-CR-167949, NAS 1 26 167949, PWA-5774-21) Avail NTIS HC A16/MF A01 CSCL 21E

A mathematical optimization procedure was developed for the structural tailoring of engine blades and was used to structurally tailor two engine fan blades constructed of composite materials without midspan shrouds The first was a solid blade made from superhybrid composites, and the second was a hollow blade with metal matrix composite inlays Three major computerized functions were needed to complete the procedure approximate analysis with the established input variables, optimization of an objective function, and refined analysis for design verification SL

N82-33392*# Teledyne Continental Motors, Mobile, Ala Aircraft Products Div
EXHAUST EMISSIONS REDUCTION FOR INTERMITTENT COMBUSTION AIRCRAFT ENGINES Final Report

Bernard J Rezy, Kenneth J Stuckas, J Ronald Tucker, and Jay E Meyers May 1982 55 p refs (Contract NAS3-19755)
(NASA-CR-167914, NAS 1 26 167914) Avail NTIS HC A04/MF A01 CSCL 21E

Three concepts which, to an aircraft piston engine, provide reductions in exhaust emissions of hydrocarbons and carbon monoxide while simultaneously improving fuel economy The three chosen concepts, (1) an improved fuel injection system, (2) an improved cooling cylinder head, and (3) exhaust air injection, when combined, show a synergistic relationship in achieving these goals In addition, the benefits of variable ignition timing were explored and both dynamometer and flight testing of the final engine configuration were accomplished SL

N82-33393*# General Electric Co, Cincinnati, Ohio Aircraft Engine Group

THE CF6 JET ENGINE PERFORMANCE IMPROVEMENT: LOW PRESSURE TURBINE ACTIVE CLEARANCE CONTROL

B D Beck and W A Fasching Jun 1982 159 p refs (Contract NAS3-20629)
(NASA-CR-165557, NAS 1 26 165557, R82AEB462) Avail NTIS HC A08/MF A01 CSCL 21E

A low pressure turbine (LPT) active clearance control (ACC) cooling system was developed to reduce the fuel consumption of current CF6-50 turbofan engines for wide bodied commercial aircraft The program performance improvement goal of 0.3% delta sfc was determined to be achievable with an improved impingement cooling system The technology enables the design of an optimized manifold and piping system which is capable of a performance gain of 0.45% delta sfc E A K

N82-33394*# Pratt and Whitney Aircraft Group, East Hartford, Conn Commercial Products Div

ENERGY EFFICIENT ENGINE: TURBINE TRANSITION DUCT MODEL TECHNOLOGY REPORT

K Leach and R Thurlin Aug 1982 113 p refs (Contract NAS3-20646)
(NASA-CR-167996, NAS 1 26 167996, PWA-5594-215) Avail NTIS HC A06/MF A01 CSCL 21E

The Low-Pressure Turbine Transition Duct Model Technology Program was directed toward substantiating the aerodynamic definition of a turbine transition duct for the Energy Efficient Engine This effort was successful in demonstrating an aerodynamically viable compact duct geometry and the performance benefits associated with a low camber low-pressure turbine inlet guide vane The transition duct design for the flight propulsion system was tested and the pressure loss goal of 0.7 percent was verified Also, strut fairing pressure distributions, as well as wall pressure

coefficients, were in close agreement with analytical predictions Duct modifications for the integrated core/low spool were also evaluated The total pressure loss was 1.59 percent Although the increase in exit area in this design produced higher wall loadings, reflecting a more aggressive aerodynamic design, pressure profiles showed no evidence of flow separation Overall, the results acquired have provided pertinent design and diagnostic information for the design of a turbine transition duct for both the flight propulsion system and the integrated core/low spool J M S

N82-33395# Garrett Turbine Engine Co, Phoenix, Ariz
CERAMIC GAS TURBINE ENGINE DEMONSTRATION PROGRAM Final Report, 2 Jan. 1976 - 31 May 1981

May 1982 125 p refs (Contract N00024-76-C-5352; DARPA Order 3155)
(AD-A117088, Rept-21-4410) Avail NTIS HC A06/MF A01 CSCL 21/5

Ceramics, because of their stability at high temperature, have the potential to improve the power and fuel efficiency of gas turbine engines by allowing engine operation at higher temperature with minimum cooling penalty The DARPA/NAVY/Garrett Ceramic Gas Turbine Engine Demonstration Program was begun in 1976 with the objective of demonstrating that ceramics could be designed, fabricated, and built into a gas turbine engine and that the engine could be operated with higher power and lower specific fuel consumption than a baseline metallic engine Extensive design, ceramic component processing development, material property evaluation, proof testing, nondestructive evaluation development, and rig and engine testing were conducted An engine containing first-stage ceramic rotor blades (with the other components metallic) was successfully operated at design speed (41,730 rpm) and at an average turbine inlet temperature of 2200 F under severe cyclic conditions for 15 hours An engine containing a ceramic hot section consisting of two full turbine stages (102 separate ceramic parts) was successfully operated in single cycles at design speed and at 2200 F producing 30 percent greater power and consuming 7 percent less fuel than the baseline metallic engine Cyclic testing of the all-ceramic hot section was not successful because of a contact stress problem that would have required engine redesign GRA

N82-33396# Tennessee Univ Space Inst, Tullahoma
NUMERICAL STABILITY ANALYSIS OF A COMPRESSOR MODEL Final Report, 1 Sep. 1980 - 1 Dec. 1981

K C Reddy and Yeng-Yung Tsui Arnold Air Force Station, Tenn AEDC Jul 1982 67 p refs (Contract F40600-80-C-0006)
(AD-A116878, AEDC-TR-82-16, UTSI-82-5) Avail NTIS HC A03/MF A01 CSCL 21/5

Various numerical schemes for solving the equations of a compressor model are analyzed Runge-Kutta scheme, JRS scheme and MacCormack scheme have been studied Proper imposition of the boundary conditions has been found to be critical for the numerical stability of these schemes An accurate method of prescribing the boundary conditions by the use of characteristics has been developed With this method of boundary conditions numerically stable results have been obtained for different test cases by all three numerical schemes Author (GRA)

N82-33397# New Jersey Inst of Tech, Newark Dept of Chemical Engineering

PREDICTIVE MODEL FOR JET ENGINE TEST CELL OPACITY Final Report, 1 Jul. 1980 - 30 Sep. 1981

Gordon A Lewandowski Tyndall AFB, Fla AFESC 30 Sep 1981 74 p refs (Contract F08635-80-C-0222, AF Proj 1900)
(AD-A117585, AFESC/ESL-TR-81-46) Avail NTIS HC A04/MF A01 CSCL 09/2

A computer program (written in FORTRAN for a CDC 6600) was developed to predict the plume opacity of jet engine test cells The data input required for the model includes the particle density, concentration, and size distribution in the exhaust gas, and the effective stack diameter Previous data obtained for J-57

engines were used to test the model, and the difference between the theoretical and measured transmittance was generally within one percent. The program also predicts the theoretical effect of using electrostatic precipitators or venturi scrubbers to treat the exhaust emissions. These predictions indicate that control devices larger than the test cells would have to be installed to even achieve a minimal effect on the observed visibility. Author (GRA)

N82-33398*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A GROUND-SIMULATOR INVESTIGATION OF HELICOPTER LONGITUDINAL FLYING QUALITIES FOR INSTRUMENT APPROACH

J V Lebacqz, R D Forrest (FAA, Moffett Field, Calif), and R M Gerdes Sep. 1982 91 p refs
 (NASA-TM-84225, A-8983, NAS 1.15 84225) Avail. NTIS HC A05/MF A01 CSCL 01C

A ground-simulation experiment was conducted to investigate the direct and interactive influences of several longitudinal static and dynamic stability parameters on helicopter flying qualities during terminal-area operations in instrument conditions. Variations that were examined included five levels of static control-position gradients ranging from stable to unstable; two levels of dynamic stability for the long-period oscillation, two levels of the steady-state pitch speed gradient, two levels of angle-of-attack stability and pitch-rate damping, and two levels of stability and control augmentation. These variations were examined initially in calm air and then in simulated light-to-moderate turbulence and wind shear. Five pilots performed a total of 223 evaluations of these parameters for a representative microwave landing system precision approach task conducted in a dual-pilot crew-loading situation. Author

N82-33400*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
ANALYSIS OF SEVERAL GLIDE PATH AND SPEED CONTROL AUTOPILOT CONCEPTS FOR A POWERED LIFT STOL AIRCRAFT

W S Hindson Aug 1982 58 p refs
 (NASA-TM-84282, A-9005, NAS 1.15 84282) Avail. NTIS HC A04/MF A01 CSCL 01C

Longitudinal performance and control utilization data are compared for several different automatic approach autopilot implementations in a powered lift STOL aircraft. As few as two, to as many as four laws reflecting both backside and frontside control techniques. The data are developed from analysis and simulation, but represent configurations which were demonstrated in flight. Transient response characteristics from initial glidepath offsets are presented, along with system operation in turbulence. In furnishing quantitative data in controlled levels of simulated turbulence, these results provide a useful supplement to various flight investigations (including those employing manual control) that involved a comparison of control techniques in this type of aircraft. SL

N82-33401# Dynamic Controls, Inc., Dayton, Ohio
FLIGHT TESTS OF A GE AND DCI DIRECT DRIVE FLY BY WIRE FLIGHT CONTROL SYSTEM Final Report, Oct. 1978 - Apr. 1981

Wright-Patterson AFB, Ohio AFWAL Jun. 1982 108 p refs
 (Contract F33615-78-C-3609, AF Proj 1987)
 (AD-A117244; AFWAL-TR-82-3035) Avail. NTIS HC A06/MF A01 CSCL 01/3

This report describes the flight test of two Fly-By-Wire flight control systems which use direct drive control valves. The test aircraft is an F-4E and the test systems are used to control the left aileron of the test aircraft. One test system was developed by the General Electric Company and the other by Dynamic Controls, Inc. The report describes the test systems, the aircraft installation, flight test and results. Author (GRA)

N82-33402# Michigan Technological Univ., Houghton. Dept of Aerospace Engineering
SYSTEM OPTIMIZATION BY PERIODIC CONTROL Final Report, 1 Oct. 1976 - 31 Jan. 1982

Elmer G Gilbert 31 Mar 1982 30 p refs
 (Grant AF-AFOSR-3158-77, AF Proj 2304)
 (AD-A117815, AFOSR-82-0575TR) Avail. NTIS HC A03/MF A01 CSCL 01/3

Research results obtained under the grant are summarized. Contributions to periodic control include theory, computational methods and applications to aircraft cruise. The theory centers around necessary or sufficient conditions for optimality and gives information on whether or not periodic operation of a dynamic system gives better performance than steady-state operation. The treatment is comprehensive and includes new second-order conditions which have simplified assumptions and incorporate control constraints. Some of these results follow from a new approach to the derivation of higher-order necessary conditions. The approach does not require normality assumptions and has provided other new results, including second-order necessary conditions in optimal control. A method for computing periodic optima is described. It addresses difficulties observed in other approaches and has proved effective in example problems. Optimal aircraft cruise (specific range, endurance, peak altitude) was studied as an application of theoretical and computational techniques. Under special circumstances (e.g., altitude constraints, in low wing loading and drag, high thrust limits), it appears that periodic cruise is significantly better than steady-state cruise. Some research was also done on the theory of nonlinear systems. It includes functional expansions for input-output maps, conditions for realizability, a backward shift approach to internally bilinear realizations and canonical forms for minimal-order realizations of two-power input-output maps. Author (GRA)

N82-33403# Comptroller General of the United States, Washington, D.C.

EXAMINATION OF THE FEDERAL AVIATION ADMINISTRATION'S PLAN FOR THE NATIONAL AIRSPACE SYSTEM Interim Report

General Accounting Office 20 Apr 1982 64 p refs
 (AFMD-82-66, B-206887) Avail. NTIS HC A04/MF A01

Resolution of issues involving budget, computer acquisition, landing systems, collision avoidance, and communications systems concerning a plan for a national airspace system is discussed. N.W

N82-33405*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

CRYOGENIC WIND TUNNELS: A SELECTED, ANNOTATED BIBLIOGRAPHY

Marie H Tuttle and Robert A Kilgore Sep 1982 62 p Supersedes NASA-TM-80168 and NASA-TM-80168-Suppl-1
 (NASA-TM-84474, L-15335, NAS 1.15 84474) Avail. NTIS HC A04/MF A01 CSCL 14B

There are 277 entries, 110 of which were added in this updated version. Selection for inclusion was made with consideration of usefulness to persons interested in building or using a cryogenic wind tunnel. SL

N82-33407# Naval Training Equipment Center, Orlando, Fla Advanced Simulation Concepts Lab

MATH MODEL DESCRIPTION FOR THE VISUAL TECHNOLOGY RESEARCH SIMULATOR (VTRS) CONVENTIONAL TAKEOFF AND LANDING (CTOL) WEAPON DELIVERY VISUAL SYSTEM Final Technical Report

Edward M Holler Jan 1982 134 p
 (AD-A117141, NAVTRAEQUIPC-IH-335) Avail. NTIS HC A07/MF A01 CSCL 12/1

This report provides a technical description of the software for weapon delivery simulation for the T-2C aircraft at the Visual Technology Research Simulator (VTRS) facility. A summary of the complete system is provided and each of the software modules is described in detail. System flow charts, axis system diagrams, math model vector diagrams, and logic tables are provided. The mathematical equations are done in FORTRAN. Pictures of visual scenes and moving models are also provided to illustrate system capability. Author (GRA)

N82-33408# Oak Ridge National Lab., Tenn
TESTING OF TRITIUM-POWERED RUNWAY DISTANCE AND TAXIWAY MARKERS Final Report, Oct. 1980 - May 1981
 K W Haff, F N Case, J A Tompkins, and F J Schultz Tyndall AFB, Fla Air Force Engineering and Services Center Aug 1981 28 p refs Sponsored by AF
 (AD-A114558, AFESC/ESL-TR-81-45) Avail NTIS HC A03/MF A01 CSCL 01/5

The Isotope Technology Group of the Oak Ridge National Laboratory's Radioisotopes Department was asked by the U S Air Force to test tritium-powered runway distance and taxiway marker signs The tests were selected by mutual agreement of the U S Air Force and Oak Ridge National Laboratory and were designed to test the serviceability of these signs under adverse weather and handling conditions, determine their limiting factors, and determine their service life The testing program results indicate that the signs will exceed strength and durability requirements for their intended purpose This report is a discussion of the testing program and the results of those tests Author (GRA)

N82-33410# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
CHINA'S NEWLY DESIGNED AND BUILT AIRCRAFT ENGINE TEST STAND

29 Jun 1982 9 p Transl into ENGLISH from Guoji Hangkong (China), no 4, Apr 1980 p 19-21
 (AD-A117569, FTD-ID(RS)T-1448-81) Avail NTIS HC A02/MF A01 CSCL 14/2

China's Newly Designed and Built Aircraft Engine Test Stand was evaluated New technology was employed in the design This included three dimensional structures which employ construction methods of entirely reinforced concrete, and a change to a reinforced concrete frame method E A K

N82-33551# Suntech, Inc., Marcus Hook, Pa
AN EXPLORATORY RESEARCH AND DEVELOPMENT PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL FROM WHOLE CRUDE SHALE OIL, PART 5 Final Report, 2 Jan. 1979 - 1 Feb. 1982

H E Reif, J P Schwedock, and A Schneider Wnght-Patterson AFB, Ohio AFWAL Mar 1982 142 p refs
 (Contract F33615-78-C-2024, AF Proj 2480)
 (AD-A117438, AFWAL-TR-82-2087-Pt-5) Avail: NTIS HC A07/MF A01 CSCL 21/4

A computer model of Sun Tech's upgrading concept for converting 100,000 BPSD of raw Occidental shale oil into aviation turbine fuels has been developed Using economic guidelines provided by the U S Air Force, the total liquid product cost when maximizing JP-4 jet fuel was \$122/gallon, \$124/gallon when maximizing JP-8 jet fuel, and \$119/gallon when producing JP-4 plus other fuels Sensitivity analysis showed that the price of raw shale oil had the greatest impact on total liquid product costs Author (GRA)

N82-33552# Virginia Inst of Marine Science, Gloucester Point
HYDROCARBON FUEL CHEMISTRY: SEDIMENT WATER INTERACTION Final Report, Nov. 1980 - Nov. 1981

W G MacIntyre, C L Smith, P O DeFur, and C W Su Tyndall AFB, Fla Air Force Engineering and Service Center Nov 1981 61 p refs
 (Contract F08635-81-C-0019, AF Proj 1900)
 (AD-A117928, AFESC/ESL-TR-82-06) Avail NTIS HC A04/MF A01 CSCL 21/4

The objective of this program was to determine the effect of sediments on aqueous solutions of selected Air Force hydrocarbon fuels Effects of sediment type, organic carbon content, pH, temperature and salinity on interaction of dissolved hydrocarbons with sediment were studied The results of this work can be used to estimate the role of sediment-hydrocarbon interaction terms in fate models of aqueous systems GRA

N82-33554# Engineering-Science, Inc., Arcadia, Calif
VAPOR CONDENSATION CONTROL OF JP-4 EMISSIONS FROM

UNDERGROUND STORAGE TANKS AT MARCH AIR FORCE BASE, CALIFORNIA Final Report, Sep. - Oct. 1981

Donald R Holtz and Lawrence C Cottone Tyndall AFB, Fla Air Force Engineering and Services Center May 1982 38 p
 (Contract F33615-80-D-4001, AF Proj 1900)
 (AD-A117875, AFESC/ESL-TR-82-01) Avail NTIS HC A03/MF A01 CSCL 06/8

Three efficiency test runs were conducted on an Edwards Engineering Corporation Hydrocarbon Vapor Recovery Unit Model DE 1000 at the March Air Force Base Panero refueling area on 22 and 23 September and 1 October 1981 The recovery system was installed to control JP-4 vapors displaced from the filling of underground tanks The purpose of the test was to assess the compliance with South Coast Air Quality Management District Rule 462 specifying minimum efficiencies for vapor condensation systems Author (GRA)

N82-33570# Naval Ship Research and Development Center, Bethesda, Md Ship Performance Dept
LIFT SYSTEM AND FAN PERFORMANCE OF AIR CUSHION SUPPORTED VEHICLES

D D Moran and A N Jennings Feb 1982 39 p refs
 (AD-A117363, DTNSRDC/SPD-0695-02) Avail NTIS HC A03/MF A01 CSCL 01/3

An analysis of the AALC JEFF lift systems and fans from the viewpoints of performance and structural design is performed A summary of performance data related to the JEFF lift systems is presented, and suggested approaches for JEFF (A) lift fan design, for which these data provided the baseline information, are provided Published methods of scaling fan performance data from model to full-scale are evaluated Finally, the structural design characteristics of the JEFF fans are discussed GRA

N82-33619# Federal Aviation Administration, Atlantic City, N J Technical Center

MEMORY AND COMPUTATIONAL REQUIREMENTS FOR TRACKING IN THE ADVANCED COMPUTER SYSTEM Final Report, Feb. 1981 - Feb. 1982

Robert E Lefferts Jun 1982 25 p refs
 (AD-A117666, DOT/FAA/CT-82/46, DOT/FAA/RD-81/75) Avail NTIS HC A02/MF A01 CSCL 17/9

Computational and memory requirements of various tracking algorithms were examined for possible application with the 9020 replacement computer For a wide range of algorithms, including those most likely to be of interest, there are no technological factors which would significantly impact the choice of algorithms given the present state of computer technology Further, within the next few years, technological advances will totally eliminate memory and computational tracking requirements from significantly impacting system design It is concluded that the only substantive limitation currently imposed on the selection of tracking algorithms is the ability of the system designer to analyze, specify, test and evaluate the most promising algorithm Author (GRA)

N82-33651# General Electric Co., Binghamton, N Y Armament and Electrical Systems Dept

MOTOR TECHNOLOGY FOR ELECTRIC REMOTELY PILOTED VEHICLE (RPV) Final Report, Sep. - Dec. 1981

M M Walters and D N Taneja Wright-Patterson AFB, Ohio AFWAL May 1982 64 p
 (Contract F33615-81-C-2056, AF Proj 3145)
 (AD-A117732, AES-13609, AFWAL-TR-82-2024) Avail NTIS HC A04/MF A01 CSCL 01/3

Electric propulsion offers significant advantages over the present gasoline engine propulsion system on a remotely piloted vehicle (RPV) The advantages are the result of technical advances in batteries, power transistors, permanent magnets and control methods This program is a continuation of an exploratory development effort by the Air Force in electric propulsion for the RPV This report presents the parametric data from a trade study of nine motor/control designs The relationship between cost, weight and efficiency of the motor/control system is determined

so that the entire RPV propulsion system can be optimized. An additional motor/control design is presented which considers a high voltage source and high speed propeller. Author (GRA)

N82-33698*# Applied Research, Inc., Huntsville, Ala
BETA EXPERIMENT FLIGHT REPORT Progress Report

Aug 1982 29 p refs
 (Contract NAS8-34337)
 (NASA-CR-170622, NAS 1 26 170622) Avail NTIS
 HC A03/MF A01 CSCL 20E

A focused laser Doppler velocimeter system was developed for the measurement of atmospheric backscatter (beta) from aerosols at infrared wavelengths. The system was flight tested at several different locations and the results of these tests are summarized. S L

N82-33712*# National Aeronautics and Space Administration,
 Marshall Space Flight Center, Huntsville, Ala

DIFFUSER/EJECTOR SYSTEM FOR A VERY HIGH VACUUM ENVIRONMENT Patent Application

Kenneth E Riggs and Carl J Wojciechowski, inventors (to NASA) (Lockheed Missiles and Space Co., Huntsville, Ala.) Filed 19 Aug 1982 18 p
 (NASA-Case-MFS-15791-1, US-Patent-Appl-SN-409678) Avail NTIS HC A02/MF A01 CSCL 13I

Turbo jet engines are used to furnish the necessary high temperature, high volume medium pressure gas to provide a high vacuum test environment at comparatively low cost for space engines at sea level. Moreover, the invention provides a unique way by use of the variable area ratio ejectors with a pair of meshing cones are used. The outer cone is arranged to translate fore and aft, and the inner cone is interchangeable with other cones having varying angles of taper. NASA

N82-33733*# National Aeronautics and Space Administration,
 Langley Research Center, Hampton, Va

RESULTS FROM TESTS OF THREE PROTOTYPE GENERAL AVIATION SEATS

M Susan Williams and Edwin L Fasanella (Kentron International, Inc., Hampton, Va.) Aug 1982 53 p refs
 (NASA-TM-84533, NAS 1 15 84533) Avail NTIS
 HC A04/MF A01 CSCL 20K

Three types of energy absorbing general aviation seats were dynamically tested and evaluated for crash load attenuation. On the basis of the static and dynamic test results, it was recommended that the tubular frame seats be redesigned to initiate stroking at approximately 12 G's rather than the 20 to 25 G range. Lower density foam was recommended for the foam wedge passenger seat. A R H

N82-33734# Georgia Inst of Tech., Atlanta School of Aerospace Engineering

HELICOPTER VIBRATION SUPPRESSION USING SIMPLE PENDULUM ABSORBERS ON THE ROTOR BLADE Final Report

G Alvin Pierce and M-Nabil H Hamouda Washington NASA Aug 1982 140 p refs Sponsored in part by Army (Grant NSG-1592)
 (NASA-CR-3619, NAS 1 26 3619) Avail NTIS HC A07/MF A01 CSCL 20K

Simple pendulums are installed on the blades of a helicopter rotor to suppress the root reactions. A frequency response analysis is conducted of typical rotor blades excited by a harmonic variation of spanwise airload distributions as well as a concentrated load at the tip. The effect of pendulum tuning on the minimization of the hub reactions is considered. A properly designed flapping pendulum attenuates the root out of plane force and moment whereas the optimum designed lead lag pendulum attenuates the root in plane reactions. A properly tuned pendulum can attenuate the vibratory loads by generating appropriate forces at its attachment point with the blade. These forces redistribute the loads on the blade so that only a small portion of the reactions is transmitted to the hub. For optimum pendulum tuning the param-

eters to be determined are the pendulum uncoupled natural frequency, the pendulum spanwise location and its mass. It is found that the optimum pendulum frequency is in the vicinity of the excitation frequency. A pendulum can be tuned and its optimum mass determined by excitation with a concentrated simple harmonic load at the tip. However, it is necessary to utilize distributed airloads to accurately determine the attenuation of the root reactions. S L

N82-33735*# Textron Bell Helicopter, Fort Worth, Tex
CRASHWORTHY AIRFRAME DESIGN CONCEPTS: FABRICATION AND TESTING Final Report, Apr. 1977 - May 1982

James D Cronkhite and V L Berry Sep 1982 206 p refs
 (Contract NAS1-14890)
 (NASA-CR-3603, NAS 1 26 3603) Avail NTIS HC A10/MF A01 CSCL 20K

Crashworthy floor concepts applicable to general aviation aircraft metal airframe structures were investigated. Initially several energy absorbing lower fuselage structure concepts were evaluated. Full scale floor sections representative of a twin engine, general aviation airplane lower fuselage structure were designed and fabricated. The floors featured an upper high strength platform with an energy absorbing, crushable structure underneath. Eighteen floors were fabricated that incorporated five different crushable subfloor concepts. The floors were then evaluated through static and dynamic testing. Computer programs NASTRAN and KRASH were used for the static and dynamic analysis of the floor section designs. Two twin engine airplane fuselages were modified to incorporate the most promising crashworthy floor sections for test evaluation. S L

N82-33736*# National Aeronautics and Space Administration,
 Langley Research Center, Hampton, Va

MEASURED AND CALCULATED EFFECTS OF ANGLE OF ATTACK ON THE TRANSONIC FLUTTER OF A SUPERCritical WING

E. Carson Yates, Jr., Eleanor C Wynne, and Moses G Farmer Aug 1982 30 p refs
 (NASA-TM-83276, NAS 1 15 83276) Avail NTIS
 HC A03/MF A01 CSCL 20K

The effects of angle of attack between 0 and 4 degrees were studied. The results indicate that increasing angle of attack from zero can produce substantial changes in the transonic flutter characteristics that are favorable or unfavorable depending on Mach number and angle of attack. The bottom of the transonic flutter-boundary 'bucket' is shown to occur at lower Mach number as angle of attack increases. These flutter results correlate well with the effects of Mach number and angle of attack on aerodynamic behavior, especially on the development of transonic flow phenomena. The calculated flutter characteristics are in good agreement with the experimental data at zero angle of attack, but at nonzero angles of attack the experiments show sharply declining and backward-turning transonic flutter boundaries that are not indicated by the calculations. These may be caused by variations in static aeroelastic deformation. C D

N82-33744*# National Aeronautics and Space Administration,
 Lewis Research Center, Cleveland, Ohio

NONLINEAR CONSTITUTIVE THEORY FOR TURBINE ENGINE STRUCTURAL ANALYSIS

Robert L Thompson /in NASA Langley Research Center Res in Struct and Solid Mech., 1982 Oct 1982 p 67-96 refs (For primary document see N82-33739 24-39)
 Avail NTIS HC A19/MF A01 CSCL 20K

A number of viscoplastic constitutive theories and a conventional constitutive theory are evaluated and compared in their ability to predict nonlinear stress-strain behavior in gas turbine engine components at elevated temperatures. Specific application of these theories is directed towards the structural analysis of combustor liners undergoing transient, cyclic, thermomechanical load histories. The combustor liner material considered in this study is Hastelloy X. The material constants for each of the theories (as a function of temperature) are obtained from existing, published experimental data. The viscoplastic theories and a conventional theory are incorporated into a general purpose, nonlinear, finite element computer program. Several numerical examples of combustor

liner structural analysis using these theories are given to demonstrate their capabilities. Based on the numerical stress-strain results, the theories are evaluated and compared. Author

N82-33758*# Auburn Univ, Ala Engineering Experiment Station

A SIMULATION LANGUAGE APPROACH TO STRUCTURAL INTERACTION PROBLEMS

Malcolm A Cutchins and James W Purvis (Sandia Labs, Albuquerque) In NASA Langley Research Center Res in Struct and Solid Mech, 1982 Oct 1982 p 301-312 refs (For primary document see N82-33739 24-39)

(Contract F08635-78-C-0027)

Avail NTIS HC A19/MF A01 CSCL 20K

Advantages and disadvantages of using simulation languages in solving structural problems are given. Structural and solid mechanics problems which have strong interactions with other disciplines are emphasized. An aeroservoelastic illustration is described with significant interactions between the dynamics of a flexible flight vehicle structure, the aerodynamics to which it is subjected, the dynamic flight equations, and the vehicle's servo-control system. E A K

N82-33954# National Weather Service, Silver Spring, Md Integrated Systems Lab

AUTOMATED LOW-COST WEATHER OBSERVATION SYSTEM (ALWOS) Final Report

Wayne Huffman and Stephen Imbembo Washington FAA Feb 1982 164 p refs Sponsored by FAA

(AD-A117447, FAA-RD-82-31) Avail NTIS HC A08/MF A01 CSCL 04/2

One of the primary objectives of this program was to design a developmental model ALWOS for the lowest possible cost. Reliability and maintenance costs over the life of the system were considered in addition to the initial purchase and installation costs. To this end, field proven, off the shelf components were used wherever possible throughout the system. Another primary objective was modularity of design. The hardware and software were constructed to allow flexibility in interfacing a variety of sensors or adding additional sensors to measure new parameters. The ALWOS as configured at Dulles Airport is a low-cost and flexible system which can provide an automatic weather observation from the data acquisition, processing and display point of view, with the potential for good long-term system reliability. After a period of familiarization with the equipment and dealing with an assortment of system and sensor problems, the functioning of the system became relatively trouble-free. Evaluation of the ALWOS supports the generally accepted concept that automated, low-cost weather observation systems can indeed perform such a function given suitable sensing devices. Author (GRA)

N82-34135# RAND Corp, Santa Monica, Calif

PALM'S THEOREM FOR NONSTATIONARY PROCESSES

Gordon B Crawford Oct 1981 43 p refs

(AD-A117089, RAND/R-2750-RC) Avail NTIS HC A03/MF A01 CSCL 12/1

This report provides both an introduction for the layman and a statement and technical proof of the dynamic form of Palm's Theorem. It is intended to help the layman develop a feeling for what is, and what is not, an appropriate application. A general statement of the theorem is given along with less general forms that are easy to use and exact in many applications. Section 2 explains the importance of the theorem to stock calculations and presents an intuitive proof of the classical form of Palm's Theorem for steady-state arrivals and discrete time. Section 3 gives several different steady-state examples to provide an understanding of what is, and what is not, a Poisson arrival process and when the dynamic form of Palm's Theorem applies. Several different statements of Palm's Theorem are developed in Section 4 to facilitate its application. These forms are used to prove what has been known as the worst-case approximation theorem. Section 4 ends with a discussion of the application of the dynamic form to the calculation of war readiness spares requirements for aircraft. GRA

N82-34188*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

NOISE MEASUREMENT IN WIND TUNNELS, WORKSHOP SUMMARY

David H Hickley (RAE, Farnborough, England) and John Williams (RAE, Farnborough, England) Sep 1982 36 p refs Workshop on Aeroacoustics Tunnel Testing Techniques held at Moffett Field, Calif, Mar 1979

(NASA-TM-84219, A-8843, NAS 1 15 84219) Avail NTIS HC A03/MF A01 CSCL 20A

In reviewing the progress made in acoustic measurements in wind tunnels over the 5-yr span of the workshops, it is evident that a great deal of progress has occurred. Specialized facilities are now on line, special measurement techniques were developed, and corrections were devised and proven. This capability is in the process of creating a new and more correct data bank on acoustic phenomena, and represents a major step forward in acoustics technology. Additional work is still required, but now, rather than concentrating on facilities and techniques, researchers may more profitably concentrate on noise-source modeling, with the simulation of propulsor noise source (in flight) and of propulsor/airframe airflow characteristics. Promising developments in directional acoustic receivers and other discrimination/correlation techniques should now be regularly exploited, in part for model noise-source diagnosis, but also to expedite extraction of the lone source signal from any residual background noise and reverberation in the working chamber and from parasitic noise due to essential rigs or instrumentation inside the airstream. A R H

N82-34189*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

SUPERSONIC JET NOISE GENERATED BY LARGE SCALE INSTABILITIES

John M Seiner, Dennis K McLaughlin (Dynamics Technology, Inc), and C H Liu Sep 1982 45 p refs

(NASA-TP-2072, L-15307, NAS 1 60 2072) Avail NTIS HC A03/MF A01 CSCL 20A

The role of large scale wavelike structures as the major mechanism for supersonic jet noise emission is examined. With the use of aerodynamic and acoustic data for low Reynolds number, supersonic jets at and below 70 thousand comparisons are made with flow fluctuation and acoustic measurements in high Reynolds number, supersonic jets. These comparisons show that a similar physical mechanism governs the generation of sound emitted in the principal noise direction. These experimental data are further compared with a linear instability theory whose prediction for the axial location of peak wave amplitude agrees satisfactorily with measured phased averaged flow fluctuation data in the low Reynolds number jets. The agreement between theory and experiment in the high Reynolds number flow differs as to the axial location for peak flow fluctuations and predicts an apparent origin for sound emission far upstream of the measured acoustic data. S L

N82-34190*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

CIRCUMFERENTIALLY SEGMENTED DUCT LINES OPTIMIZED FOR AXISYMMETRIC AND STANDING WAVE SOURCES

Willie R Watson 1982 50 p refs

(NASA-TP-2075, L-15316, NAS 1 60 2075) Avail NTIS HC A03/MF A01 CSCL 20A

Optimum and off-optimum properties of circumferentially segmented duct liners are compared with those of uniform liners to identify any potential benefits of circumferentially segmented liners. High- and low-order spinning-mode sources are considered in the study. The solution for the segmented liner is obtained by a multimodal expansion of the segmented-liner eigenmodes in terms of a series of hardwall duct models. The coefficients in the hard-wall series are obtained by using Galerkin's method. Results show that for some frequencies and duct lengths, circumferentially segmented liners scatter energy equally between a higher and lower order circumferential wave number. Studies for higher order spinning-mode sources show that an optimized segmented liner with a hard-wall/soft-wall admittance variation representing an

optimum configuration gives better performance than an optimized uniform liner. Overall, the greatest benefit of the segmented liner over the uniform liner occurs under off-optimum conditions. The optimized segmented liner gives more effective broadband performance than the optimized uniform liner. Author

**N82-34191*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
SIMULATION OF THE FLUCTUATING FIELD OF A FORCED JET**

Alvin Bayliss (New York Univ., N.Y.), Lucio Maestrello, and Eli Turkel (Tel Aviv Univ.) Aug 1982 15 p refs
(Contracts NAS1-14472, NAS1-16934, DE-AC02-76ER-03077, Grant AF-AFOSR-2881-76)
(NASA-TM-84506, NAS 1 15 84506) Avail NTIS HC A02/MF A01 CSCL 20A

The fluctuating field of a jet excited by transient mass injection is simulated numerically. The model is developed by expanding the state vector as a mean state plus a fluctuating state. Nonlinear terms are not neglected and the effect of nonlinearity is studied. The results show a significant spectral broadening in the flow field due to the nonlinearity. In addition, large scale structures are broken down into smaller scales. Author

N82-34196# Institut Franco-Allemand de Recherches, St Louis (France)

STUDY OF THE SOURCE FUNCTION BY THE CAUSALITY METHODS DEFINED BY RIBNER AND SIDDON

M Schaffar Nov 1980 22 p refs In FRENCH, ENGLISH summary
(PB82-205170, AAF-80-52) Avail NTIS HC A02/MF A01 CSCL 20A

Within the framework of Lighthill's acoustic analogy the causality technique defined by Ribner and Siddon is applied to determine the localization of the equivalent source function in a cold subsonic jet. Two methods are developed, using the above-mentioned acoustic analogy and the causality technique. The two methods give differing results. The first, which measures jet speed with a laser speed measuring device, locates the origin of sound in the duct. The second is based on the Dalembertian measurement device, more sensitive to high frequency sound produced at the wide angles of the mixing zones. Low frequency noise is located at the end of the power cone and in the transition zone. For more high frequency noises an experiment is currently underway, using the Dalembert measuring device. GRA

N82-34230# Coast Guard Research and Development Center, Groton, Conn

PRELIMINARY ASSESSMENT OF US COAST GUARD SHORT RANGE RECOVERY (SRR) FORWARD LOOKING INFRARED (FLIR) SYSTEM SMALL TARGET DETECTION PERFORMANCE Interim Report, Sep. 1981 - May 1982

S R Osmer, L Nash, G L Hover, and T J Mazour May 1982 75 p refs Prepared in cooperation with Analysis and Technology, Inc., North Stonington, Conn
(Contract DOT-CG-39-81-C-80287)
(AD-A117916, USCG-D-20-82, CGR/DC-6/82) Avail NTIS HC A04/MF A01 CSCL 17/5

Forward Looking Infrared (FLIR) detection data have been collected in a dedicated electronic detection experiment conducted in 1981 by the USCG Research and Development Center. This experiment was part of a series designed to improve search planning guidance contained in the National Search and Rescue Manual. An HH-52A helicopter equipped with a prototype Northrop Corp SeeHawk FLIR system conducted detection runs with 15- to 19-foot fiberglass boats, 4- and 7-man life rafts, and simulated person-in-water (PIW) targets. The tests were conducted in Block Island Sound during September through November 1981. GRA

**N82-34296# General Accounting Office, Washington, D. C.
Procurement Logistics and Readiness Div
AIRCRAFT THRUST/POWER MANAGEMENT CAN SAVE DE-**

FENSE FUEL, REDUCE ENGINE MAINTENANCE COSTS AND IMPROVE READINESS

29 Jul 1982 52 p refs
(AD-A117935, GA/PLRD-82-74) Avail NTIS HC A04/MF A01 CSCL 05/1

The Department of Defense spends billions of dollars annually on aircraft fuel and engine maintenance. Thrust/power management offers Defense the potential to save fuel and reduce engine maintenance by improving fuel efficiency and extending engine parts life. Improved fuel efficiency can increase flying hours and thus improve aircrew proficiency and readiness. Extended engine life can reduce frequency of maintenance and thereby increase aircraft availability and readiness. An effective thrust/power management program is vital to the Defense mission from a readiness, energy, and maintenance standpoint. The implications on readiness are quickly apparent when considering that flying hours were reduced in face of rapidly rising fuel costs. When considering the billions of dollars spent of aircraft fuel and maintenance, thrust/power management offers great potential for reducing these costs. GRA

N82-34340# Southeastern Center for Electrical Engineering Education, Inc., St Cloud, Fla

USAF SUMMER FACULTY RESEARCH PROGRAM. VOLUME 1: 1981 RESEARCH REPORTS Final Report

Warren D Peele Oct 1981 1409 p refs 2 Vol
(Contract F49620-79-C-0038, AF Proj 2305)
(AD-A113708, AFOSR-82-0227TR-Vol-1) Avail NTIS HC A99/MF A01 CSCL 05/1

The United States Air Force Summer Faculty Research Program (USAF-SFRP) is a program designed to introduce university, college, and technical institute faculty members to Air Force research. This is accomplished by the faculty members being selected on a nationally advertised competitive basis for a ten week assignment during the summer intercession to perform research at Air Force Laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the faculty member and the Air Force. In addition to compensation and travel expenses, a cost of living allowance is also paid. The USAF-SFRP is sponsored by the Air Force Office of Scientific Research/Air Force Systems Command, United States Air Force, and is conducted by the Southwestern Center for Electrical Engineering Education, Inc. This volume contains 41 papers, with abstracts. GRA

N82-34341# Southeastern Center for Electrical Engineering Education, Inc., St Cloud, Fla

USAF SUMMER FACULTY RESEARCH PROGRAM. VOLUME 2: 1981 RESEARCH REPORTS Final Report

Warren D Peele Oct 1981 1330 p refs 2 Vol
(Contract F49620-79-C-0038, AF Proj 2305)
(AD-A113709, AFOSR-82-0228TR-Vol-2) Avail NTIS HC A99/MF A01 CSCL 05/1

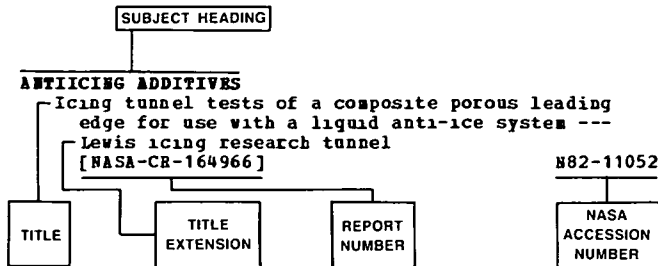
The United States Air Force Summer Faculty Research Program (USAF-SFRP) is a program designed to introduce university, college, and technical institute faculty members to Air Force research. This is accomplished by the faculty members being selected on a nationally advertised competitive basis for a ten week assignment during the summer intercession to perform research at Air Force Laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the faculty member and the Air Force. In addition to compensation and travel expenses, a cost of living allowance is also paid. The USAF-SFRP is sponsored by the Air Force Office of Scientific Research/Air Force Systems Command, United States Air Force, and is conducted by the Southeastern Center for Electrical Engineering Education, Inc. This volume contains 45 papers, with abstracts. GRA

SUBJECT INDEX

AERONAUTICAL ENGINEERING/A Continuing Bibliography (Suppl. 156)

JANUARY 1983

Typical Subject Index Listing



The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, a title extension is added, separated from the title by hyphens. The NASA or AIAA accession number is included in each entry to assist the user in locating the abstract in the abstract section of this supplement. If applicable, a report number is also included as an aid in identifying the document.

A

A-6 AIRCRAFT

Harpoon missile captive-carry dynamic environments on the A-6E aircraft N82-47072

ACCELERATED LIFE TESTS

Moisture gradient considerations in environmental fatigue of CFRP N82-45479

ACCIDENT PREVENTION

The performance of warning systems in avoiding Controlled-Flight-Into-Terrain /CFIT/ accidents N82-46255

Aircraft alerting systems standardization study. Phase 4: Accident implications on systems design [AD-A117876] N82-33388

ACOUSTIC DUCTS

Circumferentially segmented duct lines optimized for axisymmetric and standing wave sources --- reducing noise from turbofan engines galerkin method acoustic attenuation [NASA-TP-2075] N82-34190

ACOUSTIC MEASUREMENT

Effects of filter response on analysis of aircraft noise data [AD-A116458] N82-33167

Acoustic similarity laws for centrifugal fans [ESA-TI-712] N82-33172

ACTIVE CONTROL

The Shock and Vibration Digest, volume 10, no. 7 [AD-A117323] N82-32301

Active control technology in aircraft N82-32303

Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747 [NASA-CR-3164] N82-32346

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Initial ACT configuration design study [NASA-CR-3304] N82-32349

Active flutter suppression using optical output feedback digital controllers [NASA-CR-165939] N82-32375

Integrative application of active controls (IAAC) technology to an advanced subsonic transport project. Initial act configuration design study [NASA-CR-159249] N82-32380

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Conventional baseline configuration study [NASA-CR-159248] N82-32381

ADAPTIVE CONTROL

Self-tuning regulator design for adaptive control of aircraft wing/store flutter N82-45538

AEROACOUSTICS

Noise measurement in wind tunnels, workshop summary [NASA-TM-84219] N82-34188

AERODYNAMIC CHARACTERISTICS

Heavy rain/wind shear accidents N82-45825

The effect of a weak shock wave on a wing of complex planform at supersonic velocities N82-46132

A study of wing vorticity patterns N82-46621

The effect of a screen on the aerodynamic characteristics of an oscillating profile N82-46693

Long duct nacelle aerodynamic development for DC-10 derivatives [NASA-CR-159271] N82-32315

Energy efficient engine: High pressure turbine uncooled rig technology report [NASA-CR-165149] N82-32383

Propeller flow visualization techniques N82-32672

User's manual for interfacing a leading edge, vortex rollup program with two linear panel methods [NASA-TM-78584] N82-33340

The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance [AD-A117397] N82-33357

A simulation language approach to structural interaction problems N82-33758

AERODYNAMIC COEFFICIENTS

Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis N82-45849

AERODYNAMIC CONFIGURATIONS

Multibody aircraft study, volume 1 [NASA-CR-165829-VOL-1] N82-32344

Multibody aircraft study, volume 2 [NASA-CR-165829-VOL-2] N82-32345

Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747 [NASA-CR-3164] N82-32346

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Initial ACT configuration design study [NASA-CR-3304] N82-32349

Integrative application of active controls (IAAC) technology to an advanced subsonic transport project. Initial act configuration design study [NASA-CR-159249] N82-32380

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Conventional baseline configuration study [NASA-CR-159248] N82-32381

AERODYNAMIC HEATING

Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating N82-46617

AERODYNAMIC INTERFERENCE

SUBJECT INDEX

AERODYNAMIC INTERFERENCE

Investigation of the interference effects of mixed flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319

AERODYNAMIC LOADS

A simplified method for predicting rotor blade airloads
A82-45187

AERODYNAMIC NOISE

Airbus industrie and community noise
A82-45845
Noise reduction in centrifugal fans by the use of
lambda/4 resonators
[ESA-TT-723] N82-33173

AERODYNAMIC STABILITY

Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189
User's guide for the rotorcraft flight simulation computer program CB1, AGAP80 version, CDC conversion
[AD-A115801] N82-32388

AERODYNAMIC STALLING

An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245] N82-32314

AERODYNAMICS

Computational aerodynamics
A82-45851
Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection
A82-46692

Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608] A82-46847
Development of high loading, high efficiency axial flow turbine
A82-47069

Analysis of tapered-land hybrid aerostatic journal bearings
A82-47944

Computational aerodynamics and design
[NASA-TN-84257] N82-33348

AEROELASTICITY

Fundamentals of strength and aeroelasticity in flight vehicles --- Russian book
A82-45762

Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis
A82-45849

Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing
A82-46608

The effect of a screen on the aerodynamic characteristics of an oscillating profile
A82-46693

Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608] A82-46847

Aeroelastic stability of rotor blades using finite element analysis
[NASA-CR-166389] N82-32342

Propeller flow visualization techniques
N82-32672

AERONAUTICAL ENGINEERING

Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1] N82-32344

Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2] N82-32345

Computational aerodynamics and design
[NASA-TN-84257] N82-33348

USAF Summer Faculty Research Program. Volume 1: 1981 research reports
[AD-A113708] N82-34340

USAF Summer Faculty Research Program. Volume 2: 1981 research reports
[AD-A113709] N82-34341

AERONAUTICS

Romanian professor Elie Carafoli - 55 years devotion on modern aeronautics and astronautics
[IAF PAPER 82-280] A82-47010

AEROSOLS

Beta experiment flight report
[NASA-CR-170622] N82-33698

AEROSPACE ENVIRONMENTS

USAF Bioenvironmental Noise Data Handbook, volume 154
[AD-A116146] N82-33152

AEROSTATICS

Analysis of tapered-land hybrid aerostatic journal bearings
A82-47944

AIR CONDITIONING EQUIPMENT

USAF Bioenvironmental Noise Data Handbook. Volume 167: MA-3M air conditioner
[AD-A116152] N82-33159

AIR FLOW

Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366

AIR NAVIGATION

Aviation meteorology in the 1980's - A trend forecast
A82-45827
The Center Weather Service Unit program /CWSU/ --- for civil aviation
A82-45828

Weather support for helicopter operations in the Gulf of Mexico
A82-45829

The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing --- computerized weather service
A82-45830

Terrain following/terrain avoidance system concept development
N82-33363

AIR TRAFFIC

Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978
[ESA-TT-739] N82-32338

AIR TRAFFIC CONTROL

The Center Weather Service Unit program /CWSU/ --- for civil aviation
A82-45828

The choice of technology for ATC radars. I - Transmitters
A82-45981

Maximum-entropy spectral analysis of radar clutter
A82-47407

L-band DME multipath environment in the Microwave Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330

Terminal Information Processing System (TIPS) Consolidated CAB Display (CCD) comparative analysis
[FAA-CT-81-8] N82-32331

Impact of an omnidirectional traffic alert and collision avoidance system on the air traffic control radar beacon system and the discrete address beacon system
[AD-A116170] N82-32336

Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 3, 1979
[ESA-TT-740] N82-32339

TRACALS evaluation report. Special report: A procedure for RTT position improvement using linear regression analysis of glide slope structure
[AD-A115926] N82-33365

A safety appraisal of the air traffic control system
[AD-A115743] N82-33366

Study of the frequency assignment congestion in the ultra high frequency air traffic control air/ground communication band
[AD-A117640] N82-33368

Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664] N82-33369

Improving conflict alert performance using moving target detector data
[AD-A117691] N82-33370

FAA air traffic activity, FY 1981
[PB82-200361] N82-33371

Memory and computational requirements for tracking in the advanced computer system
[AD-A117666] N82-33619

AIRBORNE EQUIPMENT

Passive direction finding and signal location
A82-45346

SUBJECT INDEX

AIRCRAFT FUEL SYSTEMS

Measuring flexural loads by means of strain transducers		Active control technology in aircraft	N82-32303
A random vibration test for the evaluation of stiff sensitive component parts	A82-46619	Reflections on an F-43 in flight emergency [AD-A116873]	N82-33358
Aquila - Robot eye in the sky	A82-47073	AIRCRAFT DESIGN	
	A82-48025	Integral characteristics in the computer-aided design of geometrical objects of complex configuration	A82-46603
AIRBORNE/SPACEBORNE COMPUTERS		Parameterization in the design of surfaces by means of Coons' method --- for computer aided aircraft design	A82-46620
High Order Languages /HOL/ for flight control applications [AAS 82-020]	A82-45608	Aquila - Robot eye in the sky	A82-48025
AIRCRAFT		Multibody aircraft study, volume 1 [NASA-CR-165829-VOL-1]	N82-32344
Replacement of aboard naval aircraft [AD-A115782]	N82-32356	Multibody aircraft study, volume 2 [NASA-CR-165829-VOL-2]	N82-32345
AIRCRAFT ACCIDENT INVESTIGATION		Application of an optimized winglet configuration to an advanced commercial transport [NASA-CR-159156]	N82-32348
Post analysis of aircraft accident environments	A82-45835	Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Initial ACT configuration design study [NASA-CR-3304]	N82-32349
AIRCRAFT ACCIDENTS		Integrative application of active controls (IAAC) technology to an advanced subsonic transport project. Initial act configuration design study [NASA-CR-159249]	N82-32380
Heavy rain/wind shear accidents	A82-45825	Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Conventional baseline configuration study [NASA-CR-159248]	N82-32381
Mesoscale convective complexes and general aviation	A82-45832	Langley test highlights, 1981 [NASA-TM-84519]	N82-33330
The performance of warning systems in avoiding Controlled-Flight-Into-Terrain /CFIT/ accidents	A82-46255	Recent progress in VSTOL technology [NASA-TM-84238]	N82-33334
Considerations for optimum siting of HEBRAD to detect convective phenomena hazardous to terminal air navigation, part 1 --- meteorological radar [DOT/PAA/ED-82/56]	N82-32329	Computational aerodynamics and design [NASA-TM-84257]	N82-33348
Aircraft alerting systems standardization study. Phase 4: Accident implications on systems design [AD-A117876]	N82-33388	AIRCRAFT ENGINES	
AIRCRAFT ANTENNAS		Why GE made a moteur d'aviation	A82-45499
Geodesic paths of an ellipsoid-mounted antenna [AD-A116453]	N82-32573	The technology of the assembly of engines for flight vehicles --- Russian book	A82-45765
AIRCRAFT COMMUNICATION		The automation of processes for producing aircraft engines /2nd revised and enlarged edition/ --- Russian book	A82-45771
Automation in the skies --- automatic air traffic control	A82-47224	Optimization of dispatching discipline in queueing systems with limited queues	A82-46607
Airborne Flight Test System (APTS) [AD-A115100]	N82-32354	Development of high loading, high efficiency axial flow turbine	A82-47069
Transverse electric waves for VLF/LF communication between aircraft [AD-A115834]	N82-32582	Some design considerations for solar-powered aircraft [NASA-TP-1675]	N82-32350
AIRCRAFT COMPARTMENTS		Replacement of aboard naval aircraft [AD-A115782]	N82-32356
Examination of aircraft interior emergency lighting in a postcrash fire environment [AD-A117629]	N82-33360	High pressure bleed for STOL and STO-VL performance: A conceptual examination [AD-A115762]	N82-32357
Dayton aircraft cabin fire model, version 3. Volume 1: Physical description [AD-A117905]	N82-33361	Integrated airframe propulsion control [NASA-CR-3606]	N82-32382
AIRCRAFT CONFIGURATIONS		Survey and update of F-14A mission profiles for TF30 engine usage [AD-A116831]	N82-33337
Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis	A82-45849	Advanced turboprop testbed systems study [NASA-CR-167895]	N82-33375
Multibody aircraft study, volume 1 [NASA-CR-165829-VOL-1]	N82-32344	Structural tailoring of engine blades (STARBL) [NASA-CR-167949]	N82-33391
Multibody aircraft study, volume 2 [NASA-CR-165829-VOL-2]	N82-32345	Exhaust emissions reduction for intermittent combustion aircraft engines [NASA-CR-167914]	N82-33392
Application of an optimized winglet configuration to an advanced commercial transport [NASA-CR-159156]	N82-32348	Energy efficient engine: Turbine transition duct model technology report [NASA-CR-167996]	N82-33394
Development of a rotorcraft. Propulsion dynamics interface analysis, volume 2 [NASA-CR-166381]	N82-32369	Aircraft thrust/power management can save defense fuel, reduce engine maintenance costs and improve readiness [AD-A117935]	N82-34296
Family of airfoil shapes for rotating blades --- for increased power efficiency and blade stability [NASA-CASE-LAR-12843-1]	N82-33372	AIRCRAFT FUEL SYSTEMS	
AIRCRAFT CONSTRUCTION MATERIALS		Commercial aircraft airframe fuel systems survey and analysis [DOT/PAA/CT-82/80]	N82-32351
Moisture gradient considerations in environmental fatigue of CFRP	A82-45479		
Honeycomb cored structures --- Russian book on aircraft construction materials	A82-45775		
Environmental exposure effects on composite materials for commercial aircraft [NASA-CR-165981]	N82-32421		
AIRCRAFT CONTROL			
Use of DFVLR in-flight simulator HFB 320 Hansa for handling qualities investigations	A82-45146		
Self-tuning regulator design for adaptive control of aircraft wing/store flutter	A82-45538		

AIRCRAFT FUELS

Characterization of an Experimental Referee
Broadened Specification (ERBS) aviation turbine
fuel and ERBS fuel blends
[NASA-TM-82883] N82-32504

Impact of advanced propeller technology on
aircraft/mission characteristics of several
general aviation aircraft
[NASA-CR-167984] N82-33347

AIRCRAFT GUIDANCE

Terrain following/terrain avoidance system concept
development
N82-33363

AIRCRAFT HAZARDS

Examination of aircraft interior emergency
lighting in a postcrash fire environment
[AD-A117629] N82-33360

Dayton aircraft cabin fire model, version 3.
Volume 1: Physical description
[AD-A117905] N82-33361

AIRCRAFT INDUSTRY

Why GE made a moteur d'aviation
N82-45499

The airplane manufacturer and meteorology --- in
prediction of weather effects on aircraft
performance
N82-45821

Foreign (turbine powered) helicopter production:
A threat to the United States production base
[AD-A116755] N82-32305

AIRCRAFT LANDING

Wind determination and wind shear detection from
flight test and airline flight data
N82-45815

Low level wind shear detection system for airport
landing approach areas using the Bertin Doppler
acoustic sounder /Sodar/
N82-45816

A tower approach to slant visual range observation
and prediction
N82-45818

Federal radionavigation plan. Volume 3:
Radionavigation system characteristics
[AD-A116470] N82-32334

Aircraft energy conservation during airport ground
operations
[AD-A116138] N82-32352

An analytical study of landing flare
[ESA-TT-656] N82-32360

TRACALS evaluation report. Special report: A
procedure for RTT position improvement using
linear regression analysis of glide slope
structure
[AD-A115926] N82-33365

AIRCRAFT MAINTENANCE

Maintenance support resource forecasting models.
Volume 2: Equivalence testing of reliability
and maintenance model and expected values model
[AD-A117149] N82-32307

Mathematical model for a maintenance program for
modern jet aircraft
[ESA-TT-724] N82-32308

Reliability and maintainability improvement
program for the AV-8A/T-7B Harrier head-up
display set, development of the signal data
converter, CV-3600/AVQ-30(V), volume 3
[AD-A115554] N82-32365

Survey and update of F-14A mission profiles for
TF30 engine usage
[AD-A116831] N82-33337

Aircraft thrust/power management can save defense
fuel, reduce engine maintenance costs and
improve readiness
[AD-A117935] N82-34296

AIRCRAFT MANEUVERS

Use of DFVLR in-flight simulator HFB 320 Hansa for
handling qualities investigations
N82-45146

Energy methods used in air combat performance
comparisons
N82-45850

An analytical study of landing flare
[ESA-TT-656] N82-32360

AIRCRAFT NOISE

The determination of the duration of an exposure
to aircraft noise --- German thesis
N82-45221

Airbus industrie and community noise
N82-45845

Planning for noise impact around airports
N82-45847

Exterior noise on the fuselage of light propeller
driven aircraft in flight
N82-46114

Operational evaluation of a propeller test stand
in the quiet flow facility at Langley Research
Center
[NASA-TM-84523] N82-33149

Evaluation of noise control technology and
alternative noise certification procedures for
propeller-driven small airplanes
[AD-A116495] N82-33151

USAF Bioenvironmental Noise Data Handbook. Volume
149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153

Executive summary of systems analysis to develop
future civil aircraft noise reduction alternatives
[AD-A116467] N82-33162

Effects of filter response on analysis of aircraft
noise data
[AD-A116458] N82-33167

Noise measurement in wind tunnels, workshop summary
[NASA-TM-84219] N82-34188

Supersonic jet noise generated by large scale
instabilities
[NASA-TP-2072] N82-34189

AIRCRAFT PARTS

An analogy method for crack initiation life
prediction
N82-45192

AIRCRAFT PERFORMANCE

Heavy rain/wind shear accidents
N82-45825

Finite element approach to the calculation of
unsteady aerodynamic influence coefficients in
dynamic aeroelastic analysis
N82-45849

Energy methods used in air combat performance
comparisons
N82-45850

Aquila - Robot eye in the sky
N82-48025

Some design considerations for solar-powered
aircraft
[NASA-TP-1675] N82-32350

AIRCRAFT PRODUCTION

Selected furnace brazed components for the
aerospace industry
N82-46529

AIRCRAFT SAFETY

The performance of warning systems in avoiding
Controlled-Flight-Into-Terrain /CFIT/ accidents
N82-46255

Efficient transfer of weather information to the
pilot in flight
[NASA-CR-165889] N82-32363

A safety appraisal of the air traffic control system
[AD-A115743] N82-33366

FAA air traffic activity, FY 1981
[PB82-200361] N82-33371

AIRCRAFT STABILITY

Toward a better understanding of helicopter
stability derivatives
[NASA-TM-84277] N82-32376

Curved flow wind tunnel test of F-18 aircraft
[NASA-CR-169345] N82-33339

AIRCRAFT STRUCTURES

Fundamentals of strength and aeroelasticity in
flight vehicles --- Russian book
N82-45762

Integral characteristics in the computer-aided
design of geometrical objects of complex
configuration
N82-46603

Variational equation of an eccentrically
reinforced panel with allowance for nonuniform
heating
N82-46617

Parameterization in the design of surfaces by
means of Coons' method --- for computer aided
aircraft design
N82-46620

Prediction of fatigue crack propagation in plane
specimens and thin-walled structural elements of
aircraft wing skin under programmed loading
N82-47229

- Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724] N82-32425
- AIRCRAFT WAKES**
Transonic applications of the Wake Imaging System
N82-32676
- AIRFOIL PROFILES**
Family of airfoil shapes for rotating blades --- for increased power efficiency and blade stability
[NASA-CASB-LAB-12843-1] N82-33372
- AIRFOILS**
An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245] N82-32314
Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels
[NASA-TN-84847] N82-32384
- AIRFRAME MATERIALS**
Replacement of aboard naval aircraft
[AD-A115782] N82-32356
- AIRFRAMES**
Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method --- German thesis
N82-45219
Integrated airframe propulsion control
[NASA-CR-3606] N82-32382
Crashworthy airframe design concepts: Fabrication and testing
[NASA-CR-3603] N82-33735
- AIRLINE OPERATIONS**
Aircraft energy conservation during airport ground operations
[AD-A116138] N82-32352
FAA air traffic activity, FY 1981
[PB82-200361] N82-33371
- AIRPORT PLANNING**
Phoenix airport solar photovoltaic concentrator project
N82-44940
Planning for noise impact around airports
N82-45847
Airfield construction - A reference book --- in Russian
N82-48264
- AIRPORTS**
A modular automated approach to airfield weather systems
N82-45813
Low level wind shear detection system for airport landing approach areas using the Bertin Doppler acoustic sounder /Sodar/
N82-45816
A tower approach to slant visual range observation and prediction
N82-45818
Development and test of a tactical visibility sensor
N82-45820
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978
[ESA-TT-739] N82-32338
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 3, 1979
[ESA-TT-740] N82-32339
Aircraft energy conservation during airport ground operations
[AD-A116138] N82-32352
Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664] N82-33369
- AIRSPACE**
Northeast corridor helicopter area navigation accuracy evaluation
[AD-A117445] N82-33367
Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664] N82-33369
Examination of the Federal Aviation Administration's plan for the National Airspace System
[AFMD-82-66] N82-33403
- ALGORITHMS**
An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method --- for computer aided design and manufacturing
N82-46628
Cost and benefits design optimization model for fault tolerant flight control systems
[NASA-CR-159281] N82-32379
Numerical applications of the physical optics approach for the calculation of radar cross sections of convex perfect scatterers
[BAE-MSN-261] N82-32600
Improving conflict alert performance using moving target detector data
[AD-A117691] N82-33370
Enhancements and algorithms for avionic information processing system design methodology
[AD-A117948] N82-33385
- ALL-WEATHER AIR NAVIGATION**
Considerations for optimum siting of HEXRAD to detect convective phenomena hazardous to terminal air navigation, part 1 --- meteorological radar
[DOT/FAA/RD-82/56] N82-32329
- ALTIMETERS**
Altitude estimation using asynchronous alpha-beta tracking filters
N82-46387
- AMPHIBIOUS VEHICLES**
Lift system and fan performance of air cushion supported vehicles
[AD-A117363] N82-33570
- ANALOG SIMULATION**
An analogy method for crack initiation life prediction
N82-45192
- ANGLE OF ATTACK**
Measured and calculated effects of angle of attack on the transonic flutter of a supercritical wing
[NASA-TN-83276] N82-33736
- ANGLES (GEOMETRY)**
Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer
N82-32697
Some NTP laser velocimeter installation and operation considerations
N82-32698
- ANNULAR FLOW**
Computation of three dimensional unsteady nonuniform flow in the blade-free annular channel of a turbomachine --- military aircraft, turbocompressors
[ONERA-MT-1982-2] N82-32372
- ANTENNA RADIATION PATTERNS**
L-band DME multipath environment in the Microwave Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330
- ANTI-ISTING FUELS**
Commercial aircraft airframe fuel systems survey and analysis
[DOT/FAA/CT-82/80] N82-32351
- ANTI-SHIP MISSILES**
Harpoon missile captive-carry dynamic environments on the A-6E aircraft
N82-47072
- AREA NAVIGATION**
Northeast corridor helicopter area navigation accuracy evaluation
[AD-A117445] N82-33367
- ASBESTOS**
Replacement of aboard naval aircraft
[AD-A115782] N82-32356
- ASSEMBLING**
The technology of the assembly of engines for flight vehicles --- Russian book
N82-45765
- ASTRONAUTICS**
Romanian professor Elie Carafoli - 55 years devotion to modern aeronautics and astronautics
[IAF PAPER 82-280] N82-47010
- ASYMPTOTIC METHODS**
An asymptotic theory of separated flow past low-aspect-ratio wings
N82-46135
- ATMOSPHERIC COMPOSITION**
Beta experiment flight report
[NASA-CR-170622] N82-33698

ATMOSPHERIC TURBULENCE

Turbulence and wind shear experiments related to aircraft operation in the terminal area

A82-45817

AUDITORY SIGNALS

Speech Command Auditory Display System (SCADS)
[AD-A117486]

N82-33387

AUTOMATED EN ROUTE ATC

Automation in the skies --- automatic air traffic control

A82-47224

AUTOMATIC CONTROL

Control of the operations of a 'flight complex'
--- Russian on ground installations to aid air and space navigation

A82-45213

The automation of processes for producing aircraft engines /2nd revised and enlarged edition/ --- Russian book

A82-45771

Analysis of several glidepath and speed control autopilot concepts for a powered lift STOL aircraft

[NASA-TM-84282]

N82-33400

AUTOMATIC FLIGHT CONTROL

Aquila - Robot eye in the sky

A82-48025

The B-747 flight control system maintenance and reliability data base for cost effectiveness tradeoff studies

[NASA-CR-159275]

N82-32378

AUTOMATIC GAIN CONTROL

Voice Interactive Systems Technology Avionics (VISTA) Program

[AD-A117288]

N82-33383

AUTOMATIC PILOTS

Analysis of several glidepath and speed control autopilot concepts for a powered lift STOL aircraft

[NASA-TM-84282]

N82-33400

AUTOMATIC WEATHER STATIONS

A modular automated approach to airfield weather systems

A82-45813

AVIONICS

A random vibration test for the evaluation of stiff sensitive component parts

A82-47073

Climatic laboratory evaluation YCH-47D helicopter

[AD-A115861]

N82-32355

Avionic system development for the Tornado F MK2

[REPT-96]

N82-32361

A-7 flight software analysis

[AD-A116179]

N82-32386

The AIDS/P-18 diffractive HUD

[AD-A116026]

N82-33382

Voice Interactive Systems Technology Avionics (VISTA) Program

[AD-A117288]

N82-33383

Development of avionics installation interface standards

[AD-A116853]

N82-33384

Enhancements and algorithms for avionic information processing system design methodology

[AD-A117948]

N82-33385

AXIAL FLOW

Numerical stability analysis of a compressor model

[AD-A116878]

N82-33396

AXIAL FLOW TURBINES

Numerical calculation of the flow in compressor and turbine cascades --- German thesis

A82-45222

Development of high loading, high efficiency axial flow turbine

A82-47069

Rotor tip clearance effects on overall and blade-element performance of axial-flow transonic fan stage

[NASA-TP-2049]

N82-33389

AXISYMMETRIC FLOW

Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection

A82-46692

Circumferentially segmented duct lines optimized for axisymmetric and standing wave sources --- reducing noise from turbofan engines galerkin method acoustic attenuation

[NASA-TP-2075]

N82-34190

B

BACKSCATTERING

Beta experiment flight report
[NASA-CR-170622]

N82-33698

BANDWIDTH

Effects of filter response on analysis of aircraft noise data

[AD-A116458]

N82-33167

BEARINGS

Subsynchronous vibrations of rotor systems

N82-32528

Labyrinth seal effects on rotor bearing system stability

[AD-A116774]

N82-32742

Engine dynamic analysis with general nonlinear finite element codes. Part 2: Bearing element implementation overall numerical characteristics and benchmarking

[NASA-CR-167944]

N82-33390

BENDING MOMENTS

Measuring flexural loads by means of strain transducers

A82-46619

BIBLIOGRAPHIES

Cryogenic wind tunnels: A selected, annotated bibliography

[NASA-TM-84474]

N82-33405

USAF Summer Faculty Research Program. Volume 1:

1981 research reports

[AD-A113708]

N82-34340

USAF Summer Faculty Research Program. Volume 2:

1981 research reports

[AD-A113709]

N82-34341

BIOACOUSTICS

USAF Bioenvironmental Noise Data Handbook. Volume 149: C-9A in-flight crew/passenger noise

[AD-A116145]

N82-33153

USAF bioenvironmental noise data handbook. Volume 162: MD-400 generator set

[AD-A116148]

N82-33155

USAF bioenvironmental noise data handbook. Volume 163: GPC-28 compressor

[AD-A116149]

N82-33156

USAF bioenvironmental noise data handbook. Volume 164: MD-1 heater, duct type, portable

[AD-A116150]

N82-33157

USAF Bioenvironmental Noise Data Handbook. Volume 165: MC-1 heater, duct type, portable

[AD-A116151]

N82-33158

USAF Bioenvironmental Noise Data Handbook. Volume 167: MA-3M air conditioner

[AD-A116152]

N82-33159

USAF bioenvironmental noise data handbook. Volume 168: MB-3 tester, pressurized cabin leakage, aircraft

[AD-A116153]

N82-33163

USAF bioenvironmental noise data handbook. Volume 158: F-106A aircraft, near and far-field noise

[AD-A116930]

N82-33168

BIODYNAMICS

Investigation of aircrew protection during emergency escape at dynamic pressures up to 1600 Q

[AD-A117552]

N82-33359

BIOGRAPHY

Romanian professor Elie Carafoli - 55 years devotion on modern aeronautics and astronautics

[IAP PAPER 82-280]

A82-47010

BLADE TIPS

Rotor tip clearance effects on overall and blade-element performance of axial-flow transonic fan stage

[NASA-TP-2049]

N82-33389

BLUNT BODIES

Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection

A82-46692

BODY-WING CONFIGURATIONS

Two-dimensional apparent masses for cross-flow sections of wing-store configurations

A82-46801

BORING AIRCRAFT

Aircraft noise reduction --- for Boeing 700 series

A82-45846

BOEING 727 AIRCRAFT
Integrated energy management study. Energy efficient transport program
[NASA-CR-158980] N82-32858

BOEING 747 AIRCRAFT
Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747
[NASA-CR-3164] N82-32346
The B-747 flight control system maintenance and reliability data base for cost effectiveness tradeoff studies
[NASA-CR-159275] N82-32378
USAF Bioenvironmental Noise Data Handbook, volume 154
[AD-A116146] N82-33152

BOUNDARY LAYER SEPARATION
An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245] N82-32314

BOUNDARY LAYER STABILITY
The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
A82-45877

BOUNDARY LAYER TRANSITION
The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
A82-45877
Heat transfer from nozzles under the conditions of flow laminarization
A82-46831

BOUNDARY VALUE PROBLEMS
Numerical stability analysis of a compressor model
[AD-A116878] N82-33396

BRACING
Selected furnace brazed components for the aerospace industry
A82-46529

C

C-9 AIRCRAFT
USAF Bioenvironmental Noise Data Handbook. Volume 149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153

CANARD CONFIGURATIONS
Langley test highlights, 1981
[NASA-TN-84519] N82-33330

CAPTIVE TESTS
Harpoon missile captive-carry dynamic environments on the A-6E aircraft
A82-47072

CARBON FIBER REINFORCED PLASTICS
Moisture gradient considerations in environmental fatigue of CFRP
A82-45479

CARBON MONOXIDE
Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914] N82-33392

CARBON STEELS
Carburized high temperature steels
[AD-A116559] N82-32467

CASCADE FLOW
Numerical calculation of the flow in compressor and turbine cascades --- German thesis
A82-45222

CENTRIFUGAL PUMPS
Acoustic similarity laws for centrifugal fans
[ESA-TR-712] N82-33172
Noise reduction in centrifugal fans by the use of lambda/4 resonators
[ESA-TR-723] N82-33173

CERAMICS
Ceramic gas turbine engine demonstration program
[AD-A117088] N82-33395

CERTIFICATION
Evaluation of noise control technology and alternative noise certification procedures for propeller-driven small airplanes
[AD-A116495] N82-33151

CH-47 HELICOPTER
Non-complex item development specification for a feasibility model of an electronic master monitor and advisory display system (EMMADS)
[AD-A117919] N82-33386

CHANNEL FLOW
Long duct nacelle aerodynamic development for DC-10 derivatives
[NASA-CR-159271] N82-32315

CHARACTERIZATION
Characterization of an Experimental Referee Broadened Specification (ERBS) aviation turbine fuel and ERBS fuel blends
[NASA-TN-82883] N82-32504

CHEMICAL ANALYSIS
Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928] N82-33552

CIRCUIT RELIABILITY
Reliability and maintainability improvement program for the AV-8A/TAV-8A Harrier head-up display set, development of the signal data converter, CV-3600/AVQ-30 (V), volume 3
[AD-A115554] N82-32365

CIRCULATION CONTROL AIRFOILS
Static investigation of the circulation control wing/upper surface blowing concept applied to the quiet short haul research aircraft
[NASA-TN-84232] N82-32343

CIVIL AVIATION
The Center Weather Service Unit program /CWSU/ --- for civil aviation
A82-45828
Executive summary of systems analysis to develop future civil aircraft noise reduction alternatives
[AD-A116467] N82-33162
Effectiveness of the Civil Aviation Security program
[AD-A117671] N82-33362
Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664] N82-33369
An Operational evaluation of head up displays for civil transport operations. NASA/PAA phase 3 report
[NASA-TP-1815] N82-33381
Automated Low-cost Weather Observation System (ALWOS)
[AD-A117447] N82-33954

CLEAR AIR TURBULENCE
Aspects of clear air turbulence severity forecasting and detection
A82-45823

CLEARANCES
Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366
Rotor tip clearance effects on overall and blade-element performance of axial-flow transonic fan stage
[NASA-TP-2049] N82-33389

CLIMATOLOGY
Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355

CLUTTER
Maximum-entropy spectral analysis of radar clutter
A82-47407

COAL LIQUEFACTION
Performance of SRC II fuels in gas-turbine combustors. Alternative-fuels-utilization program
[DE82-010471] N82-32518

COCKPITS
Speech Command Auditory Display System (SCADS)
[AD-A117486] N82-33387

COLD WEATHER TESTS
Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355

COLLISION AVOIDANCE
Automation in the skies --- automatic air traffic control
A82-47224
Impact of an omnidirectional traffic alert and collision avoidance system on the air traffic control radar beacon system and the discrete address beacon system
[AD-A116170] N82-32336

COLOR CODING
A color video display technique for flow field surveys
N82-32669

COMBAT
Energy methods used in air combat performance comparisons
A82-45850

COMBUSTION CHAMBERS

SUBJECT INDEX

- Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676] N82-32389
- Survey and update of F-14A mission profiles for TF30 engine usage
[AD-A116831] N82-33337
- COMBUSTION CHAMBERS**
- Nonlinear constitutive theory for turbine engine structural analysis
N82-33744
- COMBUSTION PRODUCTS**
- Assessment of burning characteristics of aircraft interior materials
[NASA-CR-166390] N82-32899
- COMMERCIAL AIRCRAFT**
- Exterior noise on the fuselage of light propeller driven aircraft in flight
N82-46114
- Mathematical model for a maintenance program for modern jet aircraft
[BSA-TR-724] N82-32308
- Application of an optimized winglet configuration to an advanced commercial transport
[NASA-CR-159156] N82-32348
- Effectiveness of the Civil Aviation Security program
[AD-A117671] N82-33362
- An Operational evaluation of head up displays for civil transport operations. NASA/FAA phase 3 report
[NASA-TP-1815] N82-33381
- COMPLEX SYSTEMS**
- Integral characteristics in the computer-aided design of geometrical objects of complex configuration
N82-46603
- COMPONENT RELIABILITY**
- A random vibration test for the evaluation of stiff sensitive component parts
N82-47073
- Commercial aircraft airframe fuel systems survey and analysis
[DOT/FAA/CT-82/80] N82-32351
- COMPOSITE MATERIALS**
- Composite repair system with long term latency
[AD-A116472] N82-32424
- Structural tailoring of engine blades (STAEBL)
[NASA-CR-167949] N82-33391
- COMPOSITE STRUCTURES**
- Honeycomb cored structures --- Russian book on aircraft construction materials
N82-45775
- Composite repair system with long term latency
[AD-A116472] N82-32424
- COMPRESSIBILITY**
- Finite difference modeling of rotor flows including wake effects
[NASA-TM-84280] N82-33345
- COMPRESSIBLE BOUNDARY LAYER**
- The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
N82-45877
- COMPRESSIBLE FLUIDS**
- Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
N82-45188
- COMPRESSOR ROTORS**
- Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366
- Status of laser anemometry in turbomachinery research at the Lewis Research Center
N82-32686
- COMPRESSORS**
- High pressure bleed for STOL and STO-VL performance: A conceptual examination.
[AD-A115762] N82-32357
- USAF bioenvironmental noise data handbook. Volume 163: GPC-28 compressor
[AD-A116149] N82-33156
- Numerical stability analysis of a compressor model
[AD-A116878] N82-33396
- COMPUTATION**
- Computational aerodynamics and design
[NASA-TM-84257] N82-33348
- COMPUTATIONAL FLUID DYNAMICS**
- Numerical calculation of the flow in compressor and turbine cascades --- German thesis
N82-45222
- Computational aerodynamics
N82-45851
- An asymptotic theory of separated flow past low-aspect-ratio wings
N82-46135
- Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection
N82-46692
- COMPUTER AIDED DESIGN**
- Integral characteristics in the computer-aided design of geometrical objects of complex configuration
N82-46603
- Parameterization in the design of surfaces by means of Coons' method --- for computer aided aircraft design
N82-46620
- An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method --- for computer aided design and manufacturing
N82-46628
- Cost and benefits design optimization model for fault tolerant flight control systems
[NASA-CR-159281] N82-32379
- Automated procedure for developing hybrid computer simulations of turbofan engines. Part 1: General description
[NASA-TP-1851] N82-33020
- Computational aerodynamics and design
[NASA-TM-84257] N82-33348
- Structural tailoring of engine blades (STAEBL)
[NASA-CR-167949] N82-33391
- COMPUTER PROGRAMMING**
- High Order Languages /HOL/ for flight control applications
[AAS 82-020] N82-45608
- COMPUTER PROGRAMS**
- High Order Languages /HOL/ for flight control applications
[AAS 82-020] N82-45608
- Development of a Structural Integrity Recording System (SIRS) for US Army AH-1S helicopters
[AD-A116027] N82-32364
- User's guide for the rotorcraft flight simulation computer program C81, AGAP80 version, CDC conversion
[AD-A115801] N82-32388
- Automated procedure for developing hybrid computer simulations of turbofan engines. Part 1: General description
[NASA-TP-1851] N82-33020
- Recent applications of the transonic wing analysis computer code, TWING
[NASA-TM-84283] N82-33346
- Enhancements and algorithms for avionic information processing system design methodology
[AD-A117948] N82-33385
- Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397
- Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407
- COMPUTER STORAGE DEVICES**
- Memory and computational requirements for tracking in the advanced computer system
[AD-A117666] N82-33619
- COMPUTER SYSTEMS DESIGN**
- Examination of the Federal Aviation Administration's plan for the National Airspace System
[AFMD-82-66] N82-33403
- COMPUTER TECHNIQUES**
- The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing --- computerized weather service
N82-45830
- COMPUTERIZED SIMULATION**
- Self-tuning regulator design for adaptive control of aircraft wing/store flutter
N82-45538
- Heavy rain/wind shear accidents
N82-45825
- An investigation of ring laser gyroscope random walk experiments
N82-47157

SUBJECT INDEX

CRYOGENIC WIND TUNNELS

- Computer prediction of three-dimensional potential flow fields in which aircraft propellers operate [NASA-CR-169317] N82-32312
- Impact of an omnidirectional traffic alert and collision avoidance system on the air traffic control radar beacon system and the discrete address beacon system [AD-A116170] N82-32336
- A-7 flight software analysis [AD-A116179] N82-32386
- Automated procedure for developing hybrid computer simulations of turbofan engines. Part 1: General description [NASA-TP-1851] N82-33020
- Development of methods for assessment of gliding parachute applications [AD-A117103] N82-33356
- Dayton aircraft cabin fire model, version 3. Volume 1: Physical description [AD-A117905] N82-33361
- CONCENTRATORS**
- Phoenix airport solar photovoltaic concentrator project A82-44940
- CONDENSERS**
- Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California [AD-A117875] N82-33554
- CONDENSING**
- Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California [AD-A117875] N82-33554
- CONGRESSIONAL REPORTS**
- Examination of the Federal Aviation Administration's plan for the National Airspace System [AFMD-82-66] N82-33403
- CONSTITUTIVE EQUATIONS**
- Nonlinear constitutive theory for turbine engine structural analysis N82-33744
- CONSTRUCTION**
- Airfield construction - A reference book --- in Russian A82-48264
- CONTROL BOARDS**
- Development of avionics installation interface standards [AD-A116853] N82-33384
- CONTROL CONFIGURED VEHICLES**
- Integrative application of active controls (IAAC) technology to an advanced subsonic transport project. Initial act configuration design study [NASA-CR-159249] N82-32380
- CONTROL EQUIPMENT**
- The B-747 flight control system maintenance and reliability data base for cost effectiveness tradeoff studies [NASA-CR-159275] N82-32378
- CONTROL SIMULATION**
- Use of DFVLR in-flight simulator HFB 320 Hansa for handling qualities investigations A82-45146
- CONTROL STABILITY**
- Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel [NASA-TP-2043] N82-32320
- CONTROL THEORY**
- Control of the operations of a 'flight complex' --- Russian on ground installations to aid air and space navigation A82-45213
- Design of analytical failure detection using secondary observers [NASA-TM-84284] N82-32362
- System optimization by periodic control [AD-A117815] N82-33402
- CONTROL VALVES**
- Flight tests of a GE and DCI direct drive fly by wire flight control system [AD-A117244] N82-33401
- CONTROLLERS**
- Active flutter suppression using optical output feedback digital controllers [NASA-CR-165939] N82-32375
- Universal turret system model determination and controller performance testing [AD-A117687] N82-33380
- CONVECTION CURRENTS**
- Considerations for optimum siting of NEYRAD to detect convective phenomena hazardous to terminal air navigation, part 1 --- meteorological radar [DOT/FAA/RD-82/56] N82-32329
- CONVECTIVE HEAT TRANSFER**
- Heat transfer from nozzles under the conditions of flow laminarization A82-46831
- COST ANALYSIS**
- An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5 [AD-A117438] N82-33551
- COST EFFECTIVENESS**
- Cost and benefits design optimization model for fault tolerant flight control systems [NASA-CR-159281] N82-32379
- Preliminary analysis of the benefits and costs to implement the National Airspace System Plan [AD-A117664] N82-33369
- COST ESTIMATES**
- Preliminary analysis of the benefits and costs to implement the National Airspace System Plan [AD-A117664] N82-33369
- COST REDUCTION**
- Aircraft thrust/power management can save defense fuel, reduce engine maintenance costs and improve readiness [AD-A117935] N82-34296
- CRACK INITIATION**
- An analogy method for crack initiation life prediction A82-45192
- CRACK PROPAGATION**
- Prediction of fatigue crack propagation in plane specimens and thin-walled structural elements of aircraft wing skin under programmed loading A82-47229
- CRASHES**
- Examination of aircraft interior emergency lighting in a postcrash fire environment [AD-A117629] N82-33360
- CRASHWORTHINESS**
- Results from tests of three prototype general aviation seats [NASA-TM-84533] N82-33733
- Crashworthy airframe design concepts: Fabrication and testing [NASA-CR-3603] N82-33735
- CRITICAL LOADING**
- Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating A82-46617
- CROSS FLOW**
- Two-dimensional apparent masses for cross-flow sections of wing-store configurations A82-46801
- CRUISING FLIGHT**
- A computer program for the prediction of near field noise of aircraft in cruising flight: User's guide [NASA-CR-159274] N82-33148
- CRYOGENIC WIND TUNNELS**
- Flow visualization in the Langley 0.3-meter Transonic Cryogenic Tunnel and preliminary plans for the National Transonic Facility N82-32677
- Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel N82-32678
- Laser Doppler velocimetry application in the Langley 0.3-meter Transonic Cryogenic Tunnel N82-32696
- Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer N82-32697
- Cryogenic wind tunnels: A selected, annotated bibliography [NASA-TM-84474] N82-33405

CURVED PANELS

SUBJECT INDEX

CURVED PANELS

Numerical applications of the physical optics approach for the calculation of radar cross sections of convex perfect scatterers
[BAB-MSN-261] N82-32600

CUSHIONS

Assessment of burning characteristics of aircraft interior materials
[NASA-CR-166390] N82-32899

CYCLES

System optimization by periodic control
[AD-A117815] N82-33402

CYCLIC LOADS

An analogy method for crack initiation life prediction
N82-45192

D

DAMAGE

Investigation of aircrew protection during emergency escape at dynamic pressures up to 1600 g
[AD-A117552] N82-33359

DAMPING

Rotorcraft blade mode damping identification from random responses using a recursive maximum likelihood algorithm
[NASA-CR-3600] N82-33373

DATA ACQUISITION

Reliability, Availability, Maintainability Data Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378

DATA BASES

Study of the frequency assignment congestion in the ultra high frequency air traffic control air/ground communication band
[AD-A117640] N82-33368

DATA REDUCTION

Data reduction procedures for Sea King helicopter flight trials
[AD-A117044] N82-32359

DATA TRANSMISSION

Aircraft meteorological data relay /AMDAR/
N82-45822

Airborne Flight Test System (AFTS)
[AD-A115100] N82-32354

Efficient transfer of weather information to the pilot in flight
[NASA-CR-165889] N82-32363

DC 10 AIRCRAFT

Long duct nacelle aerodynamic development for DC-10 derivatives
[NASA-CR-159271] N82-32315

Investigation of the interference effects of mixed flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319

Selected winglet and mixed flow long duct nacelle development for DC-10 derivative aircraft
[NASA-CR-3296] N82-32347

Development of a low risk augmentation system for an energy efficient transport having relaxed static stability
[NASA-CR-159166] N82-32377

Advanced turboprop testbed systems study
[NASA-CR-167895] N82-33375

DEFORMATION

Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel
N82-32678

DEGRADATION

Commercial aircraft airframe fuel systems survey and analysis
[DOT/FAA/CT-82/80] N82-32351

DEGREES OF FREEDOM

Toward a better understanding of helicopter stability derivatives
[NASA-TN-84277] N82-32376

DENSITY DISTRIBUTION

Flow field studies using holographic interferometry at Langley
N82-32682

DIESEL ENGINES

USAF bioenvironmental noise data handbook. Volume 161: A/M32A-86 generator set, diesel engine driven
[AD-A116147] N82-33154

DIFFERENTIAL EQUATIONS

Implementable differential equations for nonlinear filtering --- radar tracking
[NLR-MP-81037 U] N82-33120

DIFFRACTION

The AIDS/P-18 diffractive HUD
[AD-A116026] N82-33382

DIFFRACTION PATHS

Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453] N82-32573

DIGITAL COMMAND SYSTEMS

Active flutter suppression using optical output feedback digital controllers
[NASA-CR-165939] N82-32375

DIGITAL FILTERS

Altitude estimation using asynchronous alpha-beta tracking filters
N82-46387

DIRECT POWER GENERATORS

Phoenix airport solar photovoltaic concentrator project
N82-44940

DISCHARGE COEFFICIENT

An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist
N82-46140

DISPLAY DEVICES

Terminal Information Processing System (TIPS) Consolidated CAB Display (CCD) comparative analysis
[FAA-CT-81-8] N82-32331

The AIDS/P-18 diffractive HUD
[AD-A116026] N82-33382

Non-complex item development specification for a feasibility model of an electronic master monitor and advisory display system (EMMADS)
[AD-A117919] N82-33386

Speech Command Auditory Display System (SCADS)
[AD-A117486] N82-33387

DISTANCE MEASURING EQUIPMENT

L-band DME multipath environment in the Microwave Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330

DISTILLATION

Analysis and environmental fate of Air Force distillate and high density fuels
[AD-A115949] N82-32512

DISTRIBUTED PROCESSING

Enhancements and algorithms for avionic information processing system design methodology
[AD-A117948] N82-33385

DOPPLER RADAR

Turbulence and wind shear experiments related to aircraft operation in the terminal area
N82-45817

Maximum-entropy spectral analysis of radar clutter
N82-47407

DRAG MEASUREMENT

RSRA vertical drag test report --- rotor systems research aircraft
[NASA-CR-166399] N82-32341

DRAG REDUCTION

Investigation of the interference effects of mixed flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319

NASA research on viscous drag reduction
[NASA-TN-84518] N82-33344

DRONE AIRCRAFT

Aquila - Robot eye in the sky
N82-48025

DUCT GEOMETRY

Energy efficient engine: Turbine transition duct model technology report
[NASA-CR-167996] N82-33394

DUCTED BODIES

Long duct nacelle aerodynamic development for DC-10 derivatives
[NASA-CR-159271] N82-32315

DUCTED FANS

Acoustic similarity laws for centrifugal fans
[ESA-TT-712] N82-33172

Noise reduction in centrifugal fans by the use of lambda/4 resonators
[ESA-TT-723] N82-33173

DUCTS

Sound transmission through ducts and aircraft noise prediction, volume 1
[AD-A115783] N82-33164

DYNAMIC CHARACTERISTICS

- The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525
Rolling flow wind tunnel tests of F-18 aircraft
[NASA-CR-169344] N82-33338
Design of helicopter rotor blades for optimum
dynamic characteristics
[NASA-CR-169352] N82-33374

DYNAMIC RESPONSE

- The dynamic flexural response of propeller blades
[NASA-CR-169318] N82-32313
Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 1
[NASA-CR-166380] N82-32368

DYNAMIC STRUCTURAL ANALYSIS

- Analysis of tapered-land hybrid aerostatic journal
bearings
A82-47944
Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 1
[NASA-CR-166380] N82-32368
A simulation language approach to structural
interaction problems
N82-33758

E**ECONOMIC ANALYSIS**

- Why GE made a moteur d'aviation
A82-45499
Aviation meteorology in the 1980's - A trend
forecast
A82-45827

ECONOMIC DEVELOPMENT

- Scenarios of economic development within the
European community up to the year 2000
[ESA-TT-730] N82-33286

EFFECTIVE PERCEIVED NOISE LEVELS

- Airbus industrie and community noise
A82-45845

EJECTION SEATS

- Investigation of aircrew protection during
emergency escape at dynamic pressures up to 1600 g
[AD-A117552] N82-33359

EJECTORS

- Diffuser/ejector system for a very high vacuum
environment
[NASA-CASE-MPS-15791-1] N82-33712

ELASTIC BUCKLING

- Calculation of the stability and post-buckling
behavior of thin shell underframes using the
finite element method --- German thesis
A82-45219

ELASTIC DAMPING

- Choice of weight coefficients in the problem of
the optimal damping of the elastic oscillations
of a wing
A82-46608

ELECTRIC ENERGY STORAGE

- Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651

ELECTRIC FIELDS

- Transverse electric waves for VLF/LF communication
between aircraft
[AD-A115834] N82-32582

ELECTRIC FILTERS

- Effects of filter response on analysis of aircraft
noise data
[AD-A116458] N82-33167

ELECTRIC GENERATORS

- USAF bioenvironmental noise data handbook. Volume
161: A/M32A-86 generator set, diesel engine
driven
[AD-A116147] N82-33154
USAF bioenvironmental noise data handbook. Volume
162: MD-400 generator set
[AD-A116148] N82-33155

ELECTRIC MOTORS

- USAF bioenvironmental noise data handbook. Volume
162: MD-400 generator set
[AD-A116148] N82-33155
Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651

ELECTRICAL ENGINEERING

- USAF Summer Faculty Research Program. Volume 1:
1981 research reports
[AD-A113708] N82-34340

- USAF Summer Faculty Research Program. Volume 2:
1981 research reports
[AD-A113709] N82-34341

ELECTROMAGNETIC PULSES

- Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453] N82-32573

ELECTROMECHANICAL DEVICES

- Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651

ELECTRONIC AIRCRAFT

- Reliability, Availability, Maintainability Data
Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378

ELECTRONIC EQUIPMENT TESTS

- A random vibration test for the evaluation of
stiff sensitive component parts
A82-47073

ELECTRONIC TRANSDUCERS

- Measuring flexural loads by means of strain
transducers
A82-46619

ELLIPSOIDS

- Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453] N82-32573

EMERGENCIES

- Reflections on an F-43 in flight emergency
[AD-A116873] N82-33358

EMISSION

- Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397

ENERGY ABSORPTION

- Results from tests of three prototype general
aviation seats
[NASA-TM-84533] N82-33733
Crashworthy airframe design concepts: Fabrication
and testing
[NASA-CR-3603] N82-33735

ENERGY CONSERVATION

- Aircraft energy conservation during airport ground
operations
[AD-A116138] N82-32352
Development of a low risk augmentation system for
an energy efficient transport having relaxed
static stability
[NASA-CR-159166] N82-32377
Integrated energy management study. Energy
efficient transport program
[NASA-CR-158980] N82-32858
The CF6 jet engine performance improvement: Low
pressure turbine active clearance control
[NASA-CR-165557] N82-33393
Aircraft thrust/power management can save defense
fuel, reduce engine maintenance costs and
improve readiness
[AD-A117935] N82-34296

ENERGY DISSIPATION

- Assessment of burning characteristics of aircraft
interior materials
[NASA-CR-166390] N82-32899

ENERGY METHODS

- Energy methods used in air combat performance
comparisons
A82-45850

ENGINE AIRFRAME INTEGRATION

- Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 2
[NASA-CR-166381] N82-32369

ENGINE CONTROL

- Optimization of dispatching discipline in queueing
systems with limited queues
A82-46607

- Integrated airframe propulsion control
[NASA-CR-3606] N82-32382

ENGINE DESIGN

- Numerical calculation of the flow in compressor
and turbine cascades --- German thesis
A82-45222
Development of high loading, high efficiency axial
flow turbine
A82-47069

- Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370

ENGINE INLETS

Automated procedure for developing hybrid computer simulations of turbofan engines. Part 1: General description
[NASA-TP-1851] N82-33020

Engine dynamic analysis with general nonlinear finite element codes. Part 2: Bearing element implementation overall numerical characteristics and benchmarking
[NASA-CR-167944] N82-33390

Structural tailoring of engine blades (STAEBL)
[NASA-CR-167949] N82-33391

ENGINE INLETS

Energy efficient engine: Turbine transition duct model technology report
[NASA-TR-167996] N82-33394

ENGINE NOISE

Noise measurement in wind tunnels, workshop summary
[NASA-TM-84219] N82-34188

ENGINE PARTS

Selected furnace brazed components for the aerospace industry
N82-46529

ENGINE STARTERS

USAF bioenvironmental noise data handbook. Volume 161: A/M32A-86 generator set, diesel engine driven
[AD-A116147] N82-33154

USAF bioenvironmental noise data handbook. Volume 162: MD-400 generator set
[AD-A116148] N82-33155

ENGINE TESTS

Energy efficient engine: High pressure turbine uncooled rig technology report
[NASA-CR-165149] N82-32383

ENTROPY

Maximum-entropy spectral analysis of radar clutter
N82-47407

ENVIRONMENTAL MONITORING

Aeronautics and space report of the President: 1981 activities
[NASA-TM-84719] N82-33332

ENVIRONMENTAL TESTS

Moisture gradient considerations in environmental fatigue of CFRP
N82-45479

Analysis and environmental fate of Air Force distillate and high density fuels
[AD-A115949] N82-32512

ERROR CORRECTING DEVICES

Observability of the parameters of an inertial navigation system for a 360-deg coordinated turn
N82-47093

ERROR DETECTION CODES

Design of analytical failure detection using secondary observers
[NASA-TM-84284] N82-32362

ESCAPE SYSTEMS

Investigation of aircrew protection during emergency escape at dynamic pressures up to 1600 Q
[AD-A117552] N82-33359

EULER EQUATIONS OF MOTION

Simulation of the fluctuating field of a forced jet
[NASA-TM-84506] N82-34191

EVALUATION

A safety appraisal of the air traffic control system
[AD-A115743] N82-33366

EXHAUST EMISSION

Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914] N82-33392

EXHAUST GASES

Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397

EXHAUST NOZZLES

An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist
N82-46140

EXPERIMENTAL DESIGN

China's newly designed and built aircraft engine test stand
[AD-A117569] N82-33410

EXPOSURE

Environmental exposure effects on composite materials for commercial aircraft
[NASA-CR-165981] N82-32421

SUBJECT INDEX

EXTERNAL STORES

Two-dimensional apparent masses for cross-flow sections of wing-store configurations
N82-46801

Decoupler pylon: wing/store flutter suppressor
[NASA-CASE-LAR-12468-1] N82-32373

EXTRAPOLATION

Effects of filter response on analysis of aircraft noise data
[AD-A116458] N82-33167

F

F-4 AIRCRAFT

Reflections on an F-43 in flight emergency
[AD-A116873] N82-33358

F-14 AIRCRAFT

Survey and update of F-14A mission profiles for TF30 engine usage
[AD-A116831] N82-33337

F-15 AIRCRAFT

Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel
[NASA-TP-2043] N82-32320

F-18 AIRCRAFT

Rolling flow wind tunnel tests of F-18 aircraft
[NASA-CR-169344] N82-33338

Curved flow wind tunnel test of F-18 aircraft
[NASA-CR-169345] N82-33339

FACTORIZATION

Recent applications of the transonic wing analysis computer code, TWING
[NASA-TM-84283] N82-33346

FAN BLADES

Structural tailoring of engine blades (STAEBL)
[NASA-CR-167949] N82-33391

Lift system and fan performance of air cushion supported vehicles
[AD-A117363] N82-33570

FAR FIELDS

Measurements of mean static pressure and far field acoustics of shock containing supersonic jets
[NASA-TM-84521] N82-33150

FATIGUE (MATERIALS)

Prediction of fatigue crack propagation in plane specimens and thin-walled structural elements of aircraft wing skin under programmed loading
N82-47229

FATIGUE LIFE

An analogy method for crack initiation life prediction
N82-45192

Moisture gradient considerations in environmental fatigue of CFRP
N82-45479

Development of a Structural Integrity Recording System (SIRS) for US Army AH-15 helicopters
[AD-A116027] N82-32364

FATIGUE TESTS

Modeling of thermal effects when investigating the thermal fatigue life of the blades of a gas-turbine engine
N82-46832

FAULT TOLERANCE

Cost and benefits design optimization model for fault tolerant flight control systems
[NASA-CR-159281] N82-32379

FEEDBACK CONTROL

Active flutter suppression using optical output feedback digital controllers
[NASA-CR-165939] N82-32375

Integrated energy management study. Energy efficient transport program
[NASA-CR-158980] N82-32858

FIBER REINFORCED COMPOSITES

Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724] N82-32425

FIELD THEORY (PHYSICS)

Simulation of the fluctuating field of a forced jet
[NASA-TM-84506] N82-34191

FIGHTER AIRCRAFT

Energy methods used in air combat performance comparisons
N82-45850

- Pitts' principles still applicable - Computer monitoring of fighter aircraft emergencies
A82-46254
- High pressure bleed for STOL and STO-VL performance: A conceptual examination
[AD-A115762] N82-32357
- The AIDS/P-18 diffractive HUD
[AD-A116026] N82-33382
- FILERS**
Selected furnace brazed components for the aerospace industry
A82-46529
- FINITE DIFFERENCE THEORY**
Finite difference modeling of rotor flows including wake effects
[NASA-TN-84280] N82-33345
- FINITE ELEMENT METHOD**
Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method --- German thesis
A82-45219
- Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis
A82-45849
- Aeroelastic stability of rotor blades using finite element analysis
[NASA-CR-166389] N82-32342
- FIRES**
Examination of aircraft interior emergency lighting in a postcrash fire environment
[AD-A117629] N82-33360
- Dayton aircraft cabin fire model, version 3. Volume 1: Physical description
[AD-A117905] N82-33361
- FLAT PLATES**
The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
A82-45877
- FLEXIBLE WINGS**
Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing
A82-46608
- FLEXING**
The dynamic flexural response of propeller blades
[NASA-CR-169318] N82-32313
- FLIGHT CHARACTERISTICS**
A ground-simulator investigation of helicopter longitudinal flying qualities for instrument approach
[NASA-TN-84225] N82-33398
- FLIGHT CONDITIONS**
A modular automated approach to airfield weather systems
A82-45813
- Aspects of clear air turbulence severity forecasting and detection
A82-45823
- Post analysis of aircraft accident environments
A82-45835
- Efficient transfer of weather information to the pilot in flight
[NASA-CR-165889] N82-32363
- FLIGHT CONTROL**
High Order Languages /HOL/ for flight control applications
[AAS 82-020] A82-45608
- Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355
- Design of analytical failure detection using secondary observers
[NASA-TN-84284] N82-32362
- Development of a low risk augmentation system for an energy efficient transport having relaxed static stability
[NASA-CR-159166] N82-32377
- Cost and benefits design optimization model for fault tolerant flight control systems
[NASA-CR-159281] N82-32379
- Voice Interactive Systems Technology Avionics (VISTA) Program
[AD-A117288] N82-33383
- FLIGHT CREWS**
USAF Bioenvironmental Noise Data Handbook. Volume 149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153
- FLIGHT HAZARDS**
Post analysis of aircraft accident environments
A82-45835
- Maximum-entropy spectral analysis of radar clutter
A82-47407
- FLIGHT INSTRUMENTS**
Non-complex item development specification for a feasibility model of an electronic master monitor and advisory display system (EMMADS)
[AD-A117919] N82-33386
- Aircraft alerting systems standardization study. Phase 4: Accident implications on systems design
[AD-A117876] N82-33388
- FLIGHT PATHS**
An analytical study of landing flare
[ESA-TT-656] N82-32360
- Northeast corridor helicopter area navigation accuracy evaluation
[AD-A117445] N82-33367
- FLIGHT RECORDERS**
Chief of Naval Air Training automated management information system (CANIS) users guide
[AD-A115852] N82-33280
- FLIGHT SAFETY**
Wind determination and wind shear detection from flight test and airline flight data
A82-45815
- Low level wind shear detection system for airport landing approach areas using the Bertin Doppler acoustic sounder /Sodar/
A82-45816
- The airplane manufacturer and meteorology --- in prediction of weather effects on aircraft performance
A82-45821
- Mesoscale convective complexes and general aviation
A82-45832
- Examination of the Federal Aviation Administration's plan for the National Airspace System
[AFMD-82-66] N82-33403
- FLIGHT SIMULATION**
Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385] N82-32374
- A-7 flight software analysis
[AD-A116179] N82-32386
- Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676] N82-32389
- Development of methods for assessment of gliding parachute applications
[AD-A117103] N82-33356
- Terrain following/terrain avoidance system concept development
N82-33363
- FLIGHT SIMULATORS**
Use of DFVLR in-flight simulator HFB 320 Hansa for handling qualities investigations
A82-45146
- User's guide for the rotorcraft flight simulation computer program C81, AGAP80 version, CDC conversion
[AD-A115801] N82-32388
- A ground-simulator investigation of helicopter longitudinal flying qualities for instrument approach
[NASA-TN-84225] N82-33398
- Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407
- FLIGHT TESTS**
Data reduction procedures for Sea King helicopter flight trials
[AD-A117044] N82-32359
- Flight tests of a GE and DCI direct drive fly by wire flight control system
[AD-A117244] N82-33401
- FLIGHT TRAINING**
Chief of Naval Air Training automated management information system (CANIS) users guide
[AD-A115852] N82-33280
- FLIR DETECTORS**
Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877] N82-33379

FLOORS

Preliminary assessment of US Coast Guard Short Range Recovery (SRR) Forward Looking Infrared (FLIR) system small target detection performance [AD-A117916] N82-34230

FLOORS

Crashworthy airframe design concepts: Fabrication and testing [NASA-CR-3603] N82-33735

FLOW DIRECTION INDICATORS

A color video display technique for flow field surveys N82-32669

FLOW DISTORTION

An asymptotic theory of separated flow past low-aspect-ratio wings A82-46135

Supersonic jet noise generated by large scale instabilities [NASA-TP-2072] N82-34189

FLOW DISTRIBUTION

Computer prediction of three-dimensional potential flow fields in which aircraft propellers operate [NASA-CR-169317] N82-32312

A color video display technique for flow field surveys N82-32669

Propeller flow visualization techniques N82-32672

In-flight propeller flow visualization using fluorescent minitufts N82-32673

Flow field studies using holographic interferometry at Langley N82-32682

LV measurements with an advanced turboprop N82-32690

Simulation of the fluctuating field of a forced jet [NASA-TN-84506] N82-34191

FLOW GEOMETRY

An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist A82-46140

Curved flow wind tunnel test of F-18 aircraft [NASA-CR-169345] N82-33339

FLOW MEASUREMENT

Status of laser anemometry in turbomachinery research at the Lewis Research Center N82-32686

FLOW STABILITY

Supersonic jet noise generated by large scale instabilities [NASA-TP-2072] N82-34189

FLOW VELOCITY

An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist A82-46140

Heat transfer from nozzles under the conditions of flow laminarization A82-46831

Laser Doppler velocimetry application in the Langley 0.3-meter Transonic Cryogenic Tunnel N82-32696

Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer N82-32697

China's newly designed and built aircraft engine test stand [AD-A117569] N82-33410

FLOW VISUALIZATION

Surface flow visualization requirements for testing in NTF N82-32667

Operational flow visualization techniques in the Langley Unitary Plan Wind Tunnel N82-32671

Propeller flow visualization techniques N82-32672

In-flight propeller flow visualization using fluorescent minitufts N82-32673

Shadowgraph techniques in transonic tests with powered nacelles N82-32674

Transonic applications of the Wake Imaging System N82-32676

SUBJECT INDEX

Flow visualization in the Langley 0.3-meter Transonic Cryogenic Tunnel and preliminary plans for the National Transonic Facility N82-32677

Holographic interferometry and tomography at Ames Research Center N82-32681

Flow field studies using holographic interferometry at Langley N82-32682

FLUID DYNAMICS

Subsynchronous vibrations of rotor systems N82-32528

FLUID MECHANICS

Subsynchronous vibrations of rotor systems N82-32528

FLUID-SOLID INTERACTIONS

The effect of a screen on the aerodynamic characteristics of an oscillating profile A82-46693

FLUORESCENCE

In-flight propeller flow visualization using fluorescent minitufts N82-32673

FLUTTER

Decoupler pylon: wing/store flutter suppressor [NASA-CASE-LAR-12468-1] N82-32373

Active flutter suppression using optical output feedback digital controllers [NASA-CR-165939] N82-32375

Langley test highlights, 1981 [NASA-TN-84519] N82-33330

FLUTTER ANALYSIS

Self-tuning regulator design for adaptive control of aircraft wing/store flutter A82-45538

The effect of a screen on the aerodynamic characteristics of an oscillating profile A82-46693

Nonlinear transonic flutter analysis [AIAA PAPER 81-0608] A82-46847

Aeroelastic stability of rotor blades using finite element analysis [NASA-CR-166389] N82-32342

Measured and calculated effects of angle of attack on the transonic flutter of a supercritical wing [NASA-TN-83276] N82-33736

FLY BY WIRE CONTROL

Flight tests of a 3E and DCI direct drive fly by wire flight control system [AD-A117244] N82-33401

FOREIGN TRADE

Foreign (turbine powered) helicopter production: A threat to the United States production base [AD-A116755] N82-32305

FRACTURE STRENGTH

Carburized high temperature steels [AD-A116559] N82-32467

FREQUENCIES

Effects of filter response on analysis of aircraft noise data [AD-A116458] N82-33167

FRESNEL LENSES

Phoenix airport solar photovoltaic concentrator project A82-44940

FUEL COMBUSTION

Performance of SRC II fuels in gas-turbine combustors. Alternative-fuels-utilization program [DE82-010471] N82-32518

FUEL CONSUMPTION

Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747 [NASA-CR-3164] N82-32346

Aircraft energy conservation during airport ground operations [AD-A116138] N82-32352

Impact of advanced propeller technology on aircraft/mission characteristics of several general aviation aircraft [NASA-CR-167984] N82-33347

Exhaust emissions reduction for intermittent combustion aircraft engines [NASA-CR-167914] N82-33392

Aircraft thrust/power management can save defense fuel, reduce engine maintenance costs and improve readiness [AD-A117935] N82-34296

FUEL TESTS

Characterization of an Experimental Referee
Broadened Specification (ERBS) aviation turbine
fuel and ERBS fuel blends
[NASA-TM-82883] N82-32504

FUSELAGES

Exterior noise on the fuselage of light propeller
driven aircraft in flight N82-46114
Crashworthy airframe design concepts: Fabrication
and testing N82-33735
[NASA-CR-3603]

G**GAS CHROMATOGRAPHY**

Analysis and environmental fate of Air Force
distillate and high density fuels
[AD-A115949] N82-32512

GAS INJECTION

Investigation of the aerodynamics of axisymmetric
bodies in supersonic flow in the presence of
localized injection N82-46692

GAS TURBINE ENGINES

Modeling of thermal effects when investigating the
thermal fatigue life of the blades of a
gas-turbine engine N82-46832

Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366

Performance of SRC II fuels in gas-turbine
combustors. Alternative-fuels-utilization program
[DE82-010471] N82-32518

Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking N82-33390
[NASA-CR-167944]

Energy efficient engine: Turbine transition duct
model technology report N82-33394
[NASA-CR-167996]

GAS TURBINES

Survey and update of F-14A mission profiles for
TF30 engine usage N82-33337
[AD-A116831]
Numerical stability analysis of a compressor model
[AD-A116878] N82-33396

GEARS

Kinematic precision of gear trains
[NASA-TM-82887] N82-32733

GENERAL AVIATION AIRCRAFT

Mesoscale convective complexes and general aviation
N82-45832
Post analysis of aircraft accident environments
N82-45835

Results from tests of three prototype general
aviation seats N82-33733
[NASA-TM-84533]

Crashworthy airframe design concepts: Fabrication
and testing N82-33735
[NASA-CR-3603]

GLIDE LANDINGS

TRACALS evaluation report. Special report: A
procedure for RTT position improvement using
linear regression analysis of glide slope
structure N82-33365
[AD-A115926]

GLIDE PATHS

TRACALS evaluation report. Special report: A
procedure for RTT position improvement using
linear regression analysis of glide slope
structure N82-33365
[AD-A115926]

Analysis of several glidepath and speed control
autopilot concepts for a powered lift STOL
aircraft N82-33400
[NASA-TM-84282]

GLIDING

Development of methods for assessment of gliding
parachute applications N82-33356
[AD-A117103]

GLOBAL POSITIONING SYSTEM

Federal radionavigation plan. Volume 3:
Radionavigation system characteristics
[AD-A116470] N82-32334

GRAPHITE-EPOXY COMPOSITES

Environmental exposure effects on composite
materials for commercial aircraft
[NASA-CR-165981] N82-32421

GROUND BASED CONTROL

A ground-simulator investigation of helicopter
longitudinal flying qualities for instrument
approach N82-33398
[NASA-TM-84225]

GROUND EFFECT MACHINES

Lift system and fan performance of air cushion
supported vehicles N82-33570
[AD-A117363]

GROUND STATIONS

Airborne Flight Test System (AFTS)
[AD-A115100] N82-32354

GROUND SUPPORT EQUIPMENT

Control of the operations of a 'flight complex'
--- Russian on ground installations to aid air
and space navigation N82-45213
Automated Low-cost Weather Observation System
(ALWOS) N82-33954
[AD-A117447]

GUIDE VANES

Energy efficient engine: Turbine transition duct
model technology report N82-33394
[NASA-CR-167996]

GUN TURRETS

Universal turret system model determination and
controller performance testing N82-33380
[AD-A117687]

GYRATION

Reflections on an F-43 in flight emergency
[AD-A116873] N82-33358

H**HANDBOOKS**

USAF Bioenvironmental Noise Data Handbook, volume
154 N82-33152
[AD-A116146]

USAF bioenvironmental noise data handbook. Volume
158: F-106A aircraft, near and far-field noise
[AD-A116930] N82-33168

HARMONIC ANALYSIS

A simplified method for predicting rotor blade
airloads N82-45187

HARPOON MISSILE

Harpoon missile captive-carry dynamic environments
on the A-6E aircraft N82-47072

HARRIER AIRCRAFT

Reliability and maintainability improvement
program for the AV-8A/TAV-8A Harrier head-up
display set, development of the signal data
converter, CV-3600/AVQ-30 (V), volume 3
[AD-A115554] N82-32365

HEAD-UP DISPLAYS

Reliability and maintainability improvement
program for the AV-8A/TAV-8A Harrier head-up
display set, development of the signal data
converter, CV-3600/AVQ-30 (V), volume 3
[AD-A115554] N82-32365

An Operational evaluation of head up displays for
civil transport operations. NASA/FAA phase 3
report N82-33381
[NASA-TP-1815]

HEAT MEASUREMENT

Assessment of burning characteristics of aircraft
interior materials N82-32899
[NASA-CR-166390]

HEAT TRANSFER

The effect of heat transfer on three-dimensional
spatial stability and transition of flat plate
boundary layer at Mach 3 N82-45877

HEATING EQUIPMENT

UDAF bioenvironmental noise data handbook. Volume
164: AD-1 heater, duct type, portable
[AD-A116150] N82-33157

USAF Bioenvironmental Noise Data Handbook. Volume
165: HC-1 heater, duct type, portable
[AD-A116151] N82-33158

HELICOPTER CONTROL

Toward a better understanding of helicopter
stability derivatives N82-32376
[NASA-TM-84277]

HELICOPTER DESIGN

SUBJECT INDEX

HELICOPTER DESIGN

- A simplified method for predicting rotor blade airloads
A82-45187
- Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
A82-45188
- Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189
- Design of helicopter rotor blades for optimum dynamic characteristics
[NASA-CR-169352]
N82-33374

HELICOPTER PERFORMANCE

- Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385]
N82-32374
- The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance
[AD-A117397]
N82-33357
- A ground-simulator investigation of helicopter longitudinal flying qualities for instrument approach
[NASA-TM-84225]
N82-33398

HELICOPTER TAIL ROTORS

- RSRA vertical drag test report --- rotor systems research aircraft
[NASA-CR-166399]
N82-32341

HELICOPTERS

- Weather support for helicopter operations in the Gulf of Mexico
A82-45829
- Foreign (turbine powered) helicopter production: A threat to the United States production base
[AD-A116755]
N82-32305
- An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TM-84245]
N82-32314
- Aeroelastic stability of rotor blades using finite element analysis
[NASA-CR-166389]
N82-32342
- Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861]
N82-32355
- Data reduction procedures for Sea King helicopter flight trials
[AD-A117044]
N82-32359
- User's guide for the rotorcraft flight simulation computer program C81, AGAP80 version, CDC conversion
[AD-A115801]
N82-32388
- Finite difference modeling of rotor flows including wake effects
[NASA-TM-84280]
N82-33345
- Northeast corridor helicopter area navigation accuracy evaluation
[AD-A117445]
N82-33367
- Speech Command Auditory Display System (SCADS)
[AD-A117486]
N82-33387
- Helicopter vibration suppression using simple pendulum absorbers on the rotor blade
[NASA-CR-3619]
N82-33734

HIGH LEVEL LANGUAGES

- High Order Languages /HOL/ for flight control applications
[AAS 82-020]
A82-45608

HIGH PRESSURE

- Energy efficient engine: High pressure turbine uncooled rig technology report
[NASA-CR-165149]
N82-32383

HISTORIES

- Recent progress in VSTOL technology
[NASA-TM-84238]
N82-33334

HOLOGRAPHIC INTERFEROMETRY

- Holographic interferometry and tomography at Ames Research Center
N82-32681
- Flow field studies using holographic interferometry at Langley
N82-32682

HONEYCOMB CORES

- Honeycomb cored structures --- Russian book on aircraft construction materials
A82-45775

HORIZONTAL FLIGHT

- The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance
[AD-A117397]
N82-33357

HOVERING

- Aeroelastic stability of rotor blades using finite element analysis
[NASA-CR-166389]
N82-32342
- The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance
[AD-A117397]
N82-33357

HUMAN FACTORS ENGINEERING

- Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861]
N82-32355
- The AIDS/P-18 diffractive HUD
[AD-A116026]
N82-33382
- Speech Command Auditory Display System (SCADS)
[AD-A117486]
N82-33387
- Results from tests of three prototype general aviation seats
[NASA-TM-84533]
N82-33733

HUMAN TOLERANCES

- The determination of the duration of an exposure to aircraft noise --- German thesis
A82-45221

HYDROCARBONS

- Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914]
N82-33392
- Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928]
N82-33552

IDEAL FLUIDS

- The effect of a weak shock wave on a wing of complex planform at supersonic velocities
A82-46132

IMAGES

- Operational flow visualization techniques in the Langley Unitary Plan Wind Tunnel
N82-32671

IMAGING TECHNIQUES

- Transonic applications of the Wake Imaging System
N82-32676

IN-FLIGHT MONITORING

- Use of DFVLR in-flight simulator HPB 320 Hansa for handling qualities investigations
A82-45146
- Integrated energy management study. Energy efficient transport program
[NASA-CR-158980]
N82-32858

INERTIAL NAVIGATION

- Observability of the parameters of an inertial navigation system for a 360-deg coordinated turn
A82-47093

INFLUENCE COEFFICIENT

- Finite element approach to the calculation of unsteady aerodynamic influence coefficients in dynamic aeroelastic analysis
A82-45849

INFORMATION DISSEMINATION

- The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing --- computerized weather service
A82-45830

INFORMATION MANAGEMENT

- Terminal Information Processing System (TIPS) Consolidated CAB Display (CCD) comparative analysis
[FAA-CT-81-8]
N82-32331

INFORMATION RETRIEVAL

- The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures
A82-45834

INFORMATION SYSTEMS

- The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures
A82-45834

INFRARED RADIATION

- Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724]
N82-32425

SUBJECT INDEX

LANDING

INOCULATION

Seeding considerations for an LV system in a large transonic wind tunnel
N82-32689

INSTALLING

Some NTF laser velocimeter installation and operation considerations
N82-32698

Development of avionics installation interface standards
[AD-A116853]
N82-33384

INSTRUMENT APPROACH

A tower approach to slant visual range observation and prediction
A82-45818

A ground-simulator investigation of helicopter longitudinal flying qualities for instrument approach
[NASA-TM-84225]
N82-33398

INSTRUMENT FLIGHT RULES

FAA air traffic activity, FY 1981
[PB82-200361]
N82-33371

INTERNAL COMBUSTION ENGINES

USAF bioenvironmental noise data handbook. Volume 163: GPC-28 compressor
[AD-A116149]
N82-33156

INTERNATIONAL COOPERATION

The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures
A82-45834

INTERNATIONAL TRADE

Why GE made a mateur d'aviation
A82-45499

INVENTORY MANAGEMENT

Palm's theorem for nonstationary processes
[AD-A117089]
N82-34135

INVISID FLOW

Computation of three dimensional unsteady nonuniform flow in the blade-free annular channel of a turbomachine --- military aircraft, turbocompressors
[ONERA-NT-1982-2]
N82-32372

IONOSPHERIC PROPAGATION

Transverse electric waves for VLF/LF communication between aircraft
[AD-A115834]
N82-32582

ITERATION

Recent applications of the transonic wing analysis computer code, TWING
[NASA-TM-84283]
N82-33346

J

JET AIRCRAFT NOISE

Aircraft noise reduction --- for Boeing 700 series
A82-45846

Measurements of mean static pressure and far field acoustics of shock containing supersonic jets
[NASA-TM-84521]
N82-33150

USAF Bioenvironmental Noise Data Handbook, volume 154
[AD-A116146]
N82-33152

Sound transmission through ducts and aircraft noise prediction, volume 1
[AD-A115783]
N82-33164

Simulation of the fluctuating field of a forced jet
[NASA-TM-84506]
N82-34191

JET ENGINE FUELS

Characterization of an Experimental Referee Broadened Specification (ERBS) aviation turbine fuel and ERBS fuel blends
[NASA-TM-82883]
N82-32504

Analysis and environmental fate of Air Force distillate and high density fuels
[AD-A115949]
N82-32512

Integrated energy management study. Energy efficient transport program
[NASA-CR-158980]
N82-32858

An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5
[AD-A117438]
N82-33551

Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928]
N82-33552

JET ENGINES

USAF bioenvironmental noise data handbook. Volume 158: P-106A aircraft, near and far-field noise
[AD-A116930]
N82-33168

The CP6 jet engine performance improvement: Low pressure turbine active clearance control
[NASA-CR-165557]
N82-33393

Predictive model for jet engine test cell opacity
[AD-A117585]
N82-33397

China's newly designed and built aircraft engine test stand
[AD-A117569]
N82-33410

Diffuser/ejector system for a very high vacuum environment
[NASA-CASE-MPS-15791-1]
N82-33712

JET FLOW

Operational evaluation of a propeller test stand in the quiet flow facility at Langley Research Center
[NASA-TM-84523]
N82-33149

Simulation of the fluctuating field of a forced jet
[NASA-TM-84506]
N82-34191

JET THRUST

Operational evaluation of a propeller test stand in the quiet flow facility at Langley Research Center
[NASA-TM-84523]
N82-33149

JOURNAL BEARINGS

Analysis of tapered-land hybrid aerostatic journal bearings
A82-47944

JP-4 JET FUEL

Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California
[AD-A117875]
N82-33554

K

KALMAN FILTERS

Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189

Design of analytical failure detection using secondary observers
[NASA-TM-84284]
N82-32362

KEROSENE

Commercial aircraft airframe fuel systems survey and analysis
[DOT/FAA/CT-82/80]
N82-32351

KINEMATICS

Kinematic precision of gear trains
[NASA-TM-82887]
N82-32733

L

LABYRINTH SEALS

Labyrinth seal effects on rotor bearing system stability
[AD-A116774]
N82-32742

LABINAR BOUNDARY LAYER

Heat transfer from nozzles under the conditions of flow laminarization
A82-46831

LABINAR FLOW

Surface flow visualization requirements for testing in NTF
N82-32667

NASA research on viscous drag reduction
[NASA-TM-84518]
N82-33344

LABINATES

Environmental exposure effects on composite materials for commercial aircraft
[NASA-CR-165981]
N82-32421

Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724]
N82-32425

LAND USE

Planning for noise impact around airports
A82-45847

LANDING

Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117441]
N82-33407

LANDING AIDS

LANDING AIDS

A tower approach to slant visual range observation and prediction
A82-45818

LANDING GEAR

Measuring flexural loads by means of strain transducers
A82-46619

RSRA vertical drag test report --- rotor systems research aircraft
[NASA-CR-166399]
N82-32341

LASER ANEMOMETERS

Status of laser anemometry in turbomachinery research at the Lewis Research Center
N82-32686

Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer
N82-32697

Some NTF laser velocimeter installation and operation considerations
N82-32698

LASER DOPPLER VELOCIMETERS

A color video display technique for flow field surveys
N82-32669

Development of a laser velocimeter for a large transonic wind tunnel
N82-32688

Seeding considerations for an LV system in a large transonic wind tunnel
N82-32689

LV measurements with an advanced tu.boprop
N82-32690

Applications of a laser velocimeter in the Langley 4- by 7-meter tunnel
N82-32693

Laser Doppler velocimetry application in the Langley 0.3-meter transonic Cryogenic Tunnel
N82-32696

Some NTF laser velocimeter installation and operation considerations
N82-32698

Beta experiment flight report
[NASA-CR-170622]
N82-33698

LASER GYROSCOPES

An investigation of ring laser gyroscope random walk experiments
A82-47157

LATERAL STABILITY

Curved flow wind tunnel test of F-18 aircraft
[NASA-CR-169345]
N82-33339

LAUNCHING

Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877]
N82-33379

LEADING EDGES

User's manual for interfacing a leading edge, vortex rollup program with two linear panel methods
[NASA-TN-78584]
N82-33340

LEAKAGE

USAF bioenvironmental noise data handbook. Volume 168: MB-3 tester, pressurized cabin leakage, aircraft
[AD-A116153]
N82-33163

LEAST SQUARES METHOD

Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189

LIFT AUGMENTATION

Application of an optimized winglet configuration to an advanced commercial transport
[NASA-CR-159156]
N82-32348

LIFT DEVICES

Lift system and fan performance of air cushion supported vehicles
[AD-A117363]
N82-33570

LIFT FANS

Lift system and fan performance of air cushion supported vehicles
[AD-A117363]
N82-33570

LIGHT AIRCRAFT

Exterior noise on the fuselage of light propeller driven aircraft in flight
A82-46114

SUBJECT INDEX

Evaluation of noise control technology and alternative noise certification procedures for propeller-driven small airplanes
[AD-A116495]
N82-33151

LIGHTING EQUIPMENT

Examination of aircraft interior emergency lighting in a postcrash fire environment
[AD-A117629]
N82-33360

LININGS

Nonlinear constitutive theory for turbine engine structural analysis
N82-33744

Circumferentially segmented duct lines optimized for axisymmetric and standing wave sources --- reducing noise from turbofan engines galerkin method acoustic attenuation
[NASA-TP-2075]
N82-34190

LOGISTICS

Palm's theorem for nonstationary processes
[AD-A117089]
N82-34135

LOGISTICS MANAGEMENT

Maintenance support resource forecasting models. Volume 2: Equivalence testing of reliability and maintenance model and expected values model
[AD-A117149]
N82-32307

LONG TERM EFFECTS

Environmental exposure effects on composite materials for commercial aircraft
[NASA-CR-165981]
N82-32421

LONGITUDINAL STABILITY

Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel
[NASA-TP-2043]
N82-32320

A ground-simulator investigation of helicopter longitudinal flying qualities for instrument approach
[NASA-TN-84225]
N82-33398

LOW ALTITUDE

Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385]
N82-32374

LOW ASPECT RATIO WINGS

An asymptotic theory of separated flow past low-aspect-ratio wings
A82-46135

Recent applications of the transonic wing analysis computer code, TWING
[NASA-TN-84283]
N82-33346

LOW PASS FILTERS

Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189

LOW PRESSURE

The CP6 jet engine performance improvement: Low pressure turbine active clearance control
[NASA-CR-165557]
N82-33393

Energy efficient engine: Turbine transition duct model technology report
[NASA-CR-167996]
N82-33394

LOW SPEED

Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385]
N82-32374

LOW VISIBILITY

A tower approach to slant visual range observation and prediction
A82-45818

M

MACH NUMBER

The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
A82-45877

MAGNETIC FIELDS

Transverse electric waves for VLF/LF communication between aircraft
[AD-A115834]
N82-32582

MAINTAINABILITY

The B-747 flight control system maintenance and reliability data base for cost effectiveness tradeoff studies
[NASA-CR-159275]
N82-32378

Reliability, Availability, Maintainability Data Tracking Plan improved GUARDRAIL 5
[AD-A117933]
N82-33378

MAINTENANCE

Composite repair system with long term latency
[AD-A116472] N82-32424

MAN MACHINE SYSTEMS

Pitts' principles still applicable - Computer
monitoring of fighter aircraft emergencies
N82-46254

Voice Interactive Systems Technology Avionics
(VISTA) Program
[AD-A117288] N82-33383

MANAGEMENT INFORMATION SYSTEMS

Chief of Naval Air Training automated management
information system (CANIS) users guide
[AD-A115852] N82-33280

MANAGEMENT PLANNING

Aircraft thrust/power management can save defense
fuel, reduce engine maintenance costs and
improve readiness
[AD-A117935] N82-34296

MANIPULDS

Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366

MARINE METEOROLOGY

Weather support for helicopter operations in the
Gulf of Mexico
N82-45829

MARKEERS

Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408

MARKETING

Why GE made a moteur d'aviation
N82-45499

MAROV CHAINS

Implementable differential equations for nonlinear
filtering --- radar tracking
[NLR-MP-81037 U] N82-33120

MASS DISTRIBUTION

Two-dimensional apparent masses for cross-flow
sections of wing-store configurations
N82-46801

MASS SPECTROSCOPY

Analysis and environmental fate of Air Force
distillate and high density fuels
[AD-A115949] N82-32512

MATHEMATICAL MODELS

Mathematical model for a maintenance program for
modern jet aircraft
[ESA-TT-724] N82-32308

Cost and benefits design optimization model for
fault tolerant flight control systems
[NASA-CR-159281] N82-32379

A-7 flight software analysis
[AD-A116179] N82-32386

Dayton aircraft cabin fire model, version 3.
Volume 1: Physical description
[AD-A117905] N82-33361

Universal turret system model determination and
controller performance testing
[AD-A117687] N82-33380

Math model description for the Visual Technology
Research Simulator (VTRS) conventional takeoff
and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407

An exploratory research and development program
leading to specifications for aviation turbine
fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551

Palm's theorem for nonstationary processes
[AD-A117089] N82-34135

MAXIMUM LIKELIHOOD ESTIMATES

Modeling of a tracking radar in terms of a
nonlinear second order phase lock loop
[AD-A115628] N82-32580

MEASURING INSTRUMENTS

Study of the source function by the causality
methods defined by Ribner and Siddon
[PB82-205170] N82-34196

MECHANICAL DRIVES

Kinematic precision of gear trains
[NASA-TN-82887] N82-32733

MECHANICAL PROPERTIES

Determination of material properties by limited
scan X-ray tomography
[AD-A116670] N82-32422

MECHANICAL SHOCK

The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

MESOSCALE PHENOMENA

Mesoscale convective complexes and general aviation
N82-45832

METAL JOINTS

Selected furnace brazed components for the
aerospace industry
N82-46529

METEOROLOGICAL INSTRUMENTS

Automated Low-cost Weather Observation System
(ALWOS)
[AD-A117447] N82-33954

METEOROLOGICAL PARAMETERS

Aspects of clear air turbulence severity
forecasting and detection
N82-45823

METEOROLOGICAL RADAR

Considerations for optimum siting of NEXRAD to
detect convective phenomena hazardous to
terminal air navigation, part 1 ---
meteorological radar
[DOT/FAA/RD-82/56] N82-32329

METEOROLOGICAL SERVICES

Development and test of a tactical visibility sensor
N82-45820

The airplane manufacturer and meteorology --- in
prediction of weather effects on aircraft
performance
N82-45821

Aircraft meteorological data relay /AMDAR/
N82-45822

Aviation meteorology in the 1980's - A trend
forecast
N82-45827

The Center Weather Service Unit program /CWSU/ ---
for civil aviation
N82-45828

Weather support for helicopter operations in the
Gulf of Mexico
N82-45829

The Aviation Route Forecast /ARF/ program - An
interactive system for Pilot Self-Briefing ---
computerized weather service
N82-45830

The WSI real-time aviation weather information
system - An alternative to standard general
aviation weather briefing procedures
N82-45834

Efficient transfer of weather information to the
pilot in flight
[NASA-CR-165889] N82-32363

MICROCOMPUTERS

Attribute requirements for a simulated flight
scenario microcomputer test
[AD-A115676] N82-32389

MICROPROCESSORS

A modular automated approach to airfield weather
systems
N82-45813

MICROWAVE LANDING SYSTEMS

Automation in the skies --- automatic air traffic
control
N82-47224

L-band DME multipath environment in the Microwave
Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330

Federal radionavigation plan. Volume 3:
Radionavigation system characteristics
[AD-A116470] N82-32334

MICROWAVE SCATTERING

Two-frequency J. W. Johnson, W. L. Jones
N82-47493

MILITARY AIRCRAFT

Study of the frequency assignment congestion in
the ultra high frequency air traffic control
air/ground communication band
[AD-A117640] N82-33368

MILITARY HELICOPTERS

Development of a Structural Integrity Recording
System (SIRS) for US Army AH-1S helicopters
[AD-A116027] N82-32364

MILITARY OPERATIONS

Survey and update of F-14A mission profiles for
TF30 engine usage
[AD-A116831] N82-33337

MILITARY TECHNOLOGY

USAF Summer Faculty Research Program. Volume 1:
1981 research reports
[AD-A113708] N82-34340

MISSILE TESTS

USAF Summer Faculty Research Program. Volume 2:
1981 research reports
[AD-A113709] N82-34341

MISSILE TESTS
Harpoon missile captive-carry dynamic environments
on the A-6E aircraft
A82-47072

MISSILE VIBRATION
Harpoon missile captive-carry dynamic environments
on the A-6E aircraft
A82-47072

MISSION PLANNING
Survey and update of F-14A mission profiles for
TF30 engine usage
[AD-A116831] N82-33337

MIXTURES
Characterization of an Experimental Referee
Broadened Specification (ERBS) aviation turbine
fuel and ERBS fuel blends
[NASA-TM-82883] N82-32504

MODAL RESPONSE
Rotorcraft blade mode damping identification from
random responses using a recursive maximum
likelihood algorithm
[NASA-CR-3600] N82-33373

MOISTURE
Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355

MOISTURE CONTENT
Moisture gradient considerations in environmental
fatigue of CFRP
A82-45479

MONOPULSE RADAR
Modeling of a tracking radar in terms of a
nonlinear second order phase lock loop
[AD-A115628] N82-32580

MOVING TARGET INDICATORS
Improving conflict alert performance using moving
target detector data
[AD-A117691] N82-33370

MRCA AIRCRAFT
The development of terrain following displays for
the Tornado aircraft
[REPT-200] N82-32337
Avionic system development for the Tornado F MK2
[REPT-96] N82-32361

MULTIPHASE FLOW
Investigation of the interference effects of mixed
flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319

N

NACELLES
Long duct nacelle aerodynamic development for
DC-10 derivatives
[NASA-CR-159271] N82-32315
Investigation of the interference effects of mixed
flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319
Selected winglet and mixed flow long duct nacelle
development for DC-10 derivative aircraft
[NASA-CR-3296] N82-32347
Shadowgraph techniques in transonic tests with
powered nacelles
A82-32674
Advanced turboprop testbed systems study
[NASA-CR-167895] N82-33375

NAVIER-STOKES EQUATION
Computational aerodynamics
A82-45851

NAVIGATION
Avionic system development for the Tornado F MK2
[REPT-96] N82-32361
A-7 flight software analysis
[AD-A116179] N82-32386

NAVIGATION AIDS
The Center Weather Service Unit program /CWSU/ ---
for civil aviation
A82-45828
Weather support for helicopter operations in the
Gulf of Mexico
A82-45829
The Aviation Route Forecast /ARF/ program - An
interactive system for Pilot Self-Briefing ---
computerized weather service
A82-45830

SUBJECT INDEX

NEAR FIELDS

A computer program for the prediction of near
field noise of aircraft in cruising flight:
User's guide
[NASA-CR-159274] N82-33148

NOISE (SOUND)

USAF Bioenvironmental Noise Data Handbook, volume
154
[AD-A116146] N82-33152
USAF Bioenvironmental Noise Data Handbook. Volume
149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153
USAF bioenvironmental noise data handbook. Volume
161: A/M32A-86 generator set, diesel engine
driven
[AD-A116147] N82-33154
USAF bioenvironmental noise data handbook. Volume
162: MD-480 generator set
[AD-A116148] N82-33155
USAF bioenvironmental noise data handbook. Volume
163: GPC-28 compressor
[AD-A116149] N82-33156
UDAF bioenvironmental noise data handbook. Volume
164: MD-1 heater, duct type, portable
[AD-A116150] N82-33157
USAF Bioenvironmental Noise Data Handbook. Volume
165: MC-1 heater, duct type, portable
[AD-A116151] N82-33158
USAF Bioenvironmental Noise Data Handbook. Volume
167: MA-3M air conditioner
[AD-A116152] N82-33159
USAF bioenvironmental noise data handbook. Volume
168: MB-3 tester, pressurized cabin leakage,
aircraft
[AD-A116153] N82-33163

NOISE MEASUREMENT

Exterior noise on the fuselage of light propeller
driven aircraft in flight
A82-46114
USAF Bioenvironmental Noise Data Handbook, volume
154
[AD-A116146] N82-33152
Noise measurement in wind tunnels, workshop summary
[NASA-TM-84219] N82-34188
Study of the source function by the causality
methods defined by Ribner and Siddon
[PB82-205170] N82-34196

NOISE POLLUTION

The determination of the duration of an exposure
to aircraft noise --- German thesis
A82-45221
USAF Bioenvironmental Noise Data Handbook. Volume
149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153
USAF bioenvironmental noise data handbook. Volume
161: A/M32A-86 generator set, diesel engine
driven
[AD-A116147] N82-33154
USAF bioenvironmental noise data handbook. Volume
162: MD-480 generator set
[AD-A116148] N82-33155
USAF bioenvironmental noise data handbook. Volume
163: GPC-28 compressor
[AD-A116149] N82-33156
UDAF bioenvironmental noise data handbook. Volume
164: MD-1 heater, duct type, portable
[AD-A116150] N82-33157
USAF Bioenvironmental Noise Data Handbook. Volume
165: MC-1 heater, duct type, portable
[AD-A116151] N82-33158
USAF Bioenvironmental Noise Data Handbook. Volume
167: MA-3M air conditioner
[AD-A116152] N82-33159
USAF bioenvironmental noise data handbook. Volume
168: MB-3 tester, pressurized cabin leakage,
aircraft
[AD-A116153] N82-33163
USAF bioenvironmental noise data handbook. Volume
158: F-106A aircraft, near and far-field noise
[AD-A116930] N82-33168

NOISE PREDICTION (AIRCRAFT)

A computer program for the prediction of near
field noise of aircraft in cruising flight:
User's guide
[NASA-CR-159274] N82-33148
Sound transmission through ducts and aircraft
noise prediction, volume 1
[AD-A115783] N82-33164

SUBJECT INDEX

PERCEPTION

NOISE PROPAGATION

Propeller flow visualization techniques
 Measurements of mean static pressure and far field
 acoustics of shock containing supersonic jets
 [NASA-TN-84521] N82-33150

NOISE REDUCTION

Airbus Industrie and community noise
 Aircraft noise reduction --- for Boeing 700 series
 Planning for noise impact around airports
 Evaluation of noise control technology and
 alternative noise certification procedures for
 propeller-driven small airplanes
 [AD-A116495] N82-33151
 Executive summary of systems analysis to develop
 future civil aircraft noise reduction alternatives
 [AD-A116467] N82-33162
 Noise reduction in centrifugal fans by the use of
 lambda/4 resonators
 [ESA-TT-723] N82-33173
 Circumferentially segmented duct lines optimized
 for axisymmetric and standing wave sources ---
 reducing noise from turbofan engines galerkin
 method acoustic attenuation
 [NASA-TP-2075] N82-34190

NONDESTRUCTIVE TESTS

A review of the history of nondestructive testing
 in Japan
 Aerostructure nondestructive evaluation by thermal
 field detection, phase 1: Fundamental
 information and basic technique development
 [AD-A115724] N82-32425

NONLINEAR FILTERS

Implementable differential equations for nonlinear
 filtering --- radar tracking
 [NLR-MP-81037 U] N82-33120

NONLINEAR SYSTEMS

Modeling of a tracking radar in terms of a
 nonlinear second order phase lock loop
 [AD-A115628] N82-32580

NONUNIFORM FLOW

Computation of three dimensional unsteady
 nonuniform flow in the blade-free annular
 channel of a turbomachine --- military aircraft,
 turbocompressors
 [ONERA-NT-1982-2] N82-32372

NOZZLE FLOW

Heat transfer from nozzles under the conditions of
 flow laminarization
 N82-46831

NOZZLE GEOMETRY

An experimental study of flow rate and thrust
 characteristics of a four-nozzle ejector with
 flow twist
 Effect of nozzle and vertical-tail variables on
 the performance of a 3-surface F-15 model at
 transonic Mach numbers --- Langley 16 foot
 transonic tunnel
 [NASA-TP-2043] N82-32320

NUMERICAL CONTROL

Fitts' principles still applicable - Computer
 monitoring of fighter aircraft emergencies
 Automation in the skies --- automatic air traffic
 control
 N82-46254
 N82-47224

NUMERICAL FLOW VISUALIZATION

Numerical calculation of the flow in compressor
 and turbine cascades --- German thesis
 Simulation of the fluctuating field of a forced jet
 [NASA-TN-84506] N82-34191

NUMERICAL INTEGRATION

Numerical applications of the physical optics
 approach for the calculation of radar cross
 sections of convex perfect scatterers
 [BAE-MS-261] N82-32600

O

OBSERVABILITY (SYSTEMS)

Observability of the parameters of an inertial
 navigation system for a 360-deg coordinated turn
 N82-47093

OBSTACLE AVOIDANCE

Terrain following/terrain avoidance system concept
 development
 N82-33363

OCEAN DATA ACQUISITIONS SYSTEMS

Two-frequency J. W. Johnson, W. L. Jones
 A comparison of Seasat-derived wave height with
 surface data
 N82-47493
 N82-47496

OCEAN SURFACE

Two-frequency J. W. Johnson, W. L. Jones
 N82-47493

OCEANOGRAPHIC PARAMETERS

A comparison of Seasat-derived wave height with
 surface data
 N82-47496

ONBOARD EQUIPMENT

Aircraft meteorological data relay /AMDAR/
 N82-45822

OPTICAL COMMUNICATION

Airborne Flight Test System (AFTS)
 [AD-A115100] N82-32354

OPTIMAL CONTROL

Optimization of dispatching discipline in queueing
 systems with limited queues
 Choice of weight coefficients in the problem of
 the optimal damping of the elastic oscillations
 of a wing
 N82-46607
 N82-46608

Active flutter suppression using optical output
 feedback digital controllers
 [NASA-CR-165939] N82-32375
 Integrated airframe propulsion control
 [NASA-CR-3606] N82-32382
 System optimization by periodic control
 [AD-A117815] N82-33402

OPTIMIZATION

Optimization of dispatching discipline in queueing
 systems with limited queues
 Cost and benefits design optimization model for
 fault tolerant flight control systems
 [NASA-CR-159281] N82-32379
 Circumferentially segmented duct lines optimized
 for axisymmetric and standing wave sources ---
 reducing noise from turbofan engines galerkin
 method acoustic attenuation
 [NASA-TP-2075] N82-34190

OSCILLATIONS

Reflections on an F-43 in flight emergency
 [AD-A116873] N82-33358

P

PANEL METHOD (FLUID DYNAMICS)

Computational aerodynamics
 N82-45851

PARACHUTE DESCENT

Development of methods for assessment of gliding
 parachute applications
 [AD-A117103] N82-33356

PARACHUTES

Development of methods for assessment of gliding
 parachute applications
 [AD-A117103] N82-33356

PARAMETER IDENTIFICATION

Altitude estimation using asynchronous alpha-beta
 tracking filters
 Rotorcraft blade mode damping identification from
 random responses using a recursive maximum
 likelihood algorithm
 [NASA-CR-3600] N82-33373

PARAMETERIZATION

Parameterization in the design of surfaces by
 means of Coons' method --- for computer aided
 aircraft design
 N82-46620

PENDULUMS

Helicopter vibration suppression using simple
 pendulum absorbers on the rotor blade
 [NASA-CR-3619] N82-33734

PERCEPTION

Attribute requirements for a simulated flight
 scenario microcomputer test
 [AD-A115676] N82-32389

PERFORMANCE PREDICTION

SUBJECT INDEX

PERFORMANCE PREDICTION

A simplified method for predicting rotor blade airloads
A82-45187

The airplane manufacturer and meteorology --- in prediction of weather effects on aircraft performance
A82-45821

Energy methods used in air combat performance comparisons
A82-45850

Computational aerodynamics
A82-45851

Nonlinear constitutive theory for turbine engine structural analysis
N82-33744

PERFORMANCE TESTS

Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676]
N82-32389

PERTURBATION THEORY

Integrated airframe propulsion control
[NASA-CR-3606]
N82-32382

PHASE LOCKED SYSTEMS

Modeling of a tracking radar in terms of a nonlinear second order phase lock loop
[AD-A115628]
N82-32580

PHOTOVOLTAIC CELLS

Phoenix airport solar photovoltaic concentrator project
A82-44940

PHYSICAL OPTICS

Numerical applications of the physical optics approach for the calculation of radar cross sections of convex perfect scatterers
[BAE-MSN-261]
N82-32600

PILOT TRAINING

Mesoscale convective complexes and general aviation
A82-45832

PISTON ENGINES

Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914]
N82-33392

PITCH (INCLINATION)

Reflections on an F-43 in flight emergency
[AD-A116873]
N82-33358

PITCHING MOMENTS

An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245]
N82-32314

PLANFORMS

The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance
[AD-A117397]
N82-33357

PLUNES

Predictive model for jet engine test cell opacity
[AD-A117585]
N82-33397

POLLUTION CONTROL

Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California
[AD-A117875]
N82-33554

POLYNOMIALS

An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method --- for computer aided design and manufacturing
A82-46628

POSITION (LOCATION)

Passive direction finding and signal location
A82-45346

Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453]
N82-32573

POSITION ERRORS

Altitude estimation using asynchronous alpha-beta tracking filters
A82-46387

POSITION INDICATORS

Passive direction finding and signal location
A82-45346

POSTFLIGHT ANALYSIS

Post analysis of aircraft accident environments
A82-45835

POWER EFFICIENCY

Development of high loading, high efficiency axial flow turbine
A82-47069

Family of airfoil shapes for rotating blades --- for increased power efficiency and blade stability
[NASA-CASE-LAR-12843-1]
N82-33372

POWERED LIFT AIRCRAFT

Analysis of several glidepath and speed control autopilot concepts for a powered lift STOL aircraft
[NASA-TN-84282]
N82-33400

PRESIDENTIAL REPORTS

Aeronautics and space report of the President: 1981 activities
[NASA-TN-84719]
N82-33332

PRESSURE DISTRIBUTION

Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
A82-45188

An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245]
N82-32314

PRESSURE REDUCTION

High pressure bleed for STOL and STO-VL performance: A conceptual examination
[AD-A115762]
N82-32357

PRESSURIZED CABINS

USAF bioenvironmental noise data handbook. Volume 168: MB-3 tester, pressurized cabin leakage, aircraft
[AD-A116153]
N82-33163

PREVENTION

Investigation of aircrew protection during emergency escape at dynamic pressures up to 1600 g
[AD-A117552]
N82-33359

PRODUCT DEVELOPMENT

High Order Languages /HOL/ for flight control applications
[AAS 82-020]
A82-45608

The development of terrain following displays for the Tornado aircraft
[REPT-200]
N82-32337

Avionic system development for the Tornado F MK2
[REPT-96]
N82-32361

Operational flow visualization techniques in the Langley Unitary Plan Wind Tunnel
N82-32671

PRODUCTION ENGINEERING

The technology of the assembly of engines for flight vehicles --- Russian book
A82-45765

The automation of processes for producing aircraft engines /2nd revised and enlarged edition/ --- Russian book
A82-45771

PROGRAMMING LANGUAGES

A simulation language approach to structural interaction problems
N82-33758

PROP-FAN TECHNOLOGY

Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans
[NASA-CR-167928-VOL-1]
N82-32370

Advanced turboprop testbed systems study
[NASA-CR-167895]
N82-33375

PROPELLANT PROPERTIES

Characterization of an Experimental Referee Broadened Specification (ERBS) aviation turbine fuel and ERBS fuel blends
[NASA-TN-82883]
N82-32504

PROPELLER BLADES

The dynamic flexural response of propeller blades
[NASA-CR-169318]
N82-32313

Impact of advanced propeller technology on aircraft/mission characteristics of several general aviation aircraft
[NASA-CR-167984]
N82-33347

PROPELLERS

Computer prediction of three-dimensional potential flow fields in which aircraft propellers operate
[NASA-CR-169317]
N82-32312

Propeller flow visualization techniques
N82-32672

In-flight propeller flow visualization using fluorescent minitufts
N82-32673

SUBJECT INDEX

REINFORCED PLATES

Development of a laser velocimeter for a large transonic wind tunnel N82-32688

LV measurements with an advanced turboprop N82-32690

Operational evaluation of a propeller test stand in the quiet flow facility at Langley Research Center [NASA-TM-84523] N82-33149

Evaluation of noise control technology and alternative noise certification procedures for propeller-driven small airplanes [AD-A116495] N82-33151

PROPULSION SYSTEM CONFIGURATIONS

Development of a rotorcraft. Propulsion dynamics interface analysis, volume 1 [NASA-CR-166380] N82-32368

Development of a rotorcraft. Propulsion dynamics interface analysis, volume 2 [NASA-CR-166381] N82-32369

PROPULSION SYSTEM PERFORMANCE

Integrated airframe propulsion control [NASA-CR-3606] N82-32382

PYLONS

Decoupler pylon: wing/store flutter suppressor [NASA-CASE-LAR-12468-1] N82-32373

Q

QUEUEING THEORY

Optimization of dispatching discipline in queueing systems with limited queues A82-46607

QUIET ENGINE PROGRAM

Static investigation of the circulation control wing/upper surface blowing concept applied to the quiet short haul research aircraft [NASA-TM-84232] N82-32343

R

RADAR APPROACH CONTROL

Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978 [ESA-TT-739] N82-32338

Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 3, 1979 [ESA-TT-740] N82-32339

RADAR BEACONS

Impact of an omnidirectional traffic alert and collision avoidance system on the air traffic control radar beacon system and the discrete address beacon system [AD-A116170] N82-32336

RADAR CLUTTER MAPS

Maximum-entropy spectral analysis of radar clutter A82-47407

RADAR CROSS SECTIONS

Numerical applications of the physical optics approach for the calculation of radar cross sections of convex perfect scatterers [BAE-MSM-261] N82-32600

RADAR EQUIPMENT

The choice of technology for ATC radars. I - Transmitters A82-45981

RADAR MEASUREMENT

Two-frequency J. W. Johnson, W. L. Jones A82-47493

RADAR TRACKING

Altitude estimation using asynchronous alpha-beta tracking filters A82-46387

Modeling of a tracking radar in terms of a nonlinear second order phase lock loop [AD-A115628] N82-32580

Implementable differential equations for nonlinear filtering --- radar tracking [NLR-AP-81037 U] N82-33120

Improving conflict alert performance using moving target detector data [AD-A117691] N82-33370

Memory and computational requirements for tracking in the advanced computer system [AD-A117666] N82-33619

RADARSCOPES

The development of terrain following displays for the Tornado aircraft [REPT-200] N82-32337

RADIO BEACONS

Federal radionavigation plan. Volume 3: Radionavigation system characteristics [AD-A116470] N82-32334

RADIO DIRECTION FINDERS

Passive direction finding and signal location A82-45346

RADIO NAVIGATION

Federal radionavigation plan. Volume 3: Radionavigation system characteristics [AD-A116470] N82-32334

RADIO RECEIVERS

Airborne Flight Test System (AFTS) [AD-A115100] N82-32354

RADIO TRANSMITTERS

Passive direction finding and signal location A82-45346

RADIOGRAPHY

A review of the history of nondestructive testing in Japan A82-48257

RAIN

Heavy rain/wind shear accidents A82-45825

RANDOM VIBRATION

A random vibration test for the evaluation of stiff sensitive component parts A82-47073

RANDOM WALK

An investigation of ring laser gyroscope random walk experiments A82-47157

RAY TRACING

Geodesic paths of an ellipsoid-mounted antenna [AD-A116453] N82-32573

REAL TIME OPERATION

The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures A82-45834

REATTACHED FLOW

Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels [NASA-TM-84847] N82-32384

RECORDING INSTRUMENTS

Development of a Structural Integrity Recording System (SIRS) for US Army AH-1S helicopters [AD-A116027] N82-32364

RECOVERY

Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload [AD-A117877] N82-33379

REDUNDANCY ENCODING

Design of analytical failure detection using secondary observers [NASA-TM-84284] N82-32362

REFINING

An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5 [AD-A117438] N82-33551

REGRESSION ANALYSIS

TRACALS evaluation report. Special report: A procedure for RTT position improvement using linear regression analysis of glide slope structure [AD-A115926] N82-33365

REGULATIONS

Evaluation of noise control technology and alternative noise certification procedures for propeller-driven small airplanes [AD-A116495] N82-33151

REGULATORS

Self-tuning regulator design for adaptive control of aircraft wing/store flutter A82-45538

REINFORCED PLATES

Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating A82-46617

RELIABILITY

SUBJECT INDEX

RELIABILITY

Reliability, Availability, Maintainability Data
Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378

RELIABILITY ANALYSIS

Impact of an omnidirectional traffic alert and
collision avoidance system on the air traffic
control radar beacon system and the discrete
address beacon system
[AD-A116170] N82-32336

The B-747 flight control system maintenance and
reliability data base for cost effectiveness
tradeoff studies
[NASA-CR-159275] N82-32378

REMOTE SENSING

Two-frequency J. W. Johnson, W. L. Jones
A82-47493

Aeronautics and space report of the President:
1981 activities
[NASA-TM-84719] N82-33332

REMOTELY PILOTED VEHICLES

Control of the operations of a 'flight complex'
--- Russian on ground installations to aid air
and space navigation
A82-45213

Aguila - Robot eye in the sky
A82-48025

Alternative employment concepts for Remotely
Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877] N82-33379

Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651

REPLACING

Replacement of aboard naval aircraft
[AD-A115782] N82-32356

RESCUE OPERATIONS

Preliminary assessment of US Coast Guard Short
Range Recovery (SRR) Forward Looking Infrared
(FLIR) system small target detection performance
[AD-A117916] N82-34230

RESEARCH

An exploratory research and development program
leading to specifications for aviation turbine
fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551

RESEARCH AND DEVELOPMENT

Recent progress in VSTOL technology
[NASA-TM-84238] N82-33334

RESEARCH FACILITIES

Math model description for the Visual Technology
Research Simulator (VTRS) conventional takeoff
and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407

RESEARCH MANAGEMENT

USAF Summer Faculty Research Program. Volume 1:
1981 research reports
[AD-A113708] N82-34340

USAF Summer Faculty Research Program. Volume 2:
1981 research reports
[AD-A113709] N82-34341

RESONATORS

Noise reduction in centrifugal fans by the use of
lambda/4 resonators
[ESA-TT-723] N82-33173

REYNOLDS NUMBER

Surface flow visualization requirements for
testing in NTF
N82-32667

Supersonic jet noise generated by large scale
instabilities
[NASA-TP-2072] N82-34189

RING LASERS

An investigation of ring laser gyroscope random
walk experiments
A82-47157

ROCKET ENGINES

The technology of the assembly of engines for
flight vehicles --- Russian book
A82-45765

Diffuser/ejector system for a very high vacuum
environment
[NASA-CASE-MPS-15791-1] N82-33712

ROCKET EXHAUST

Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397

RODS

Measuring flexural loads by means of strain
transducers
A82-46619

ROLLING MOMENTS

Rolling flow wind tunnel tests of F-18 aircraft
[NASA-CR-169344] N82-33338

ROTARY STABILITY

Family of airfoil shapes for rotating blades ---
for increased power efficiency and blade stability
[NASA-CASE-LAR-12843-1] N82-33372

ROTARY WING AIRCRAFT

Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 2
[NASA-CR-166381] N82-32369

ROTARY WINGS

The aerodynamic influences of rotor blade taper,
twist, airfoils and solidity on hover and
forward flight performance
[AD-A117397] N82-33357

Family of airfoil shapes for rotating blades ---
for increased power efficiency and blade stability
[NASA-CASE-LAR-12843-1] N82-33372

Rotorcraft blade mode damping identification from
random responses using a recursive maximum
likelihood algorithm
[NASA-CR-3600] N82-33373

Voice Interactive Systems Technology Avionics
(VISTA) Program
[AD-A117288] N82-33383

ROTOR AERODYNAMICS

Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 1
[NASA-CR-166380] N82-32368

Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 2
[NASA-CR-166381] N82-32369

ROTOR BLADES

A simplified method for predicting rotor blade
airloads
A82-45187

Study on pressure distribution on rotor blades
with three-dimensional nonsteady theory of
compressible fluid
A82-45188

Aeroelastic stability of rotor blades using finite
element analysis
[NASA-CR-166389] N82-32342

Finite difference modeling of rotor flows
including wake effects
[NASA-TM-84280] N82-33345

Design of helicopter rotor blades for optimum
dynamic characteristics
[NASA-CR-169352] N82-33374

Rotor tip clearance effects on overall and
blade-element performance of axial-flow
transonic fan stage
[NASA-TP-2049] N82-33389

Helicopter vibration suppression using simple
pendulum absorbers on the rotor blade
[NASA-CR-3619] N82-33734

ROTOR BODY INTERACTIONS

Development of a rotorcraft. Propulsion dynamics
interface analysis, volume 1
[NASA-CR-166380] N82-32368

ROTOR SYSTEMS RESEARCH AIRCRAFT

RSRA vertical drag test report --- rotor systems
research aircraft
[NASA-CR-166399] N82-32341

ROTORS

User's guide for the rotorcraft flight simulation
computer program C81, AGAP80 version, CDC
conversion
[AD-A115801] N82-32388

The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

Subsynchronous vibrations of rotor systems
N82-32528

Labyrinth seal effects on rotor bearing system
stability
[AD-A116774] N82-32742

Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390

RUNGE-KUTTA METHOD

Numerical stability analysis of a compressor model
[AD-A116878] N82-33396

RUNWAY CONDITIONS

Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408

RUNWAY LIGHTS

Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408

RUNWAYS

Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408

S**SABOTAGE**

Effectiveness of the Civil Aviation Security program
[AD-A117671] N82-33362

SANDWICH STRUCTURES

Honeycomb cored structures --- Russian book on
aircraft construction materials
N82-45775

SCALE MODELS

Acoustic similarity laws for centrifugal fans
[ESA-TT-712] N82-33172

SCATTEROMETERS

Development and test of a tactical visibility sensor
N82-45820

SCHLIEREN PHOTOGRAPHY

Operational flow visualization techniques in the
Langley Unitary Plan Wind Tunnel
N82-32671

Shadowgraph techniques in transonic tests with
powered nacelles
N82-32674

SCREEN EFFECT

The effect of a screen on the aerodynamic
characteristics of an oscillating profile
N82-46693

SCRUBBERS

Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397

SEA STATES

A comparison of Seasat-derived wave height with
surface data
N82-47496

SEASAT SATELLITES

A comparison of Seasat-derived wave height with
surface data
N82-47496

SEATS

Assessment of burning characteristics of aircraft
interior materials
[NASA-CR-166390] N82-32899
Results from tests of three prototype general
aviation seats
[NASA-TN-84533] N82-33733

SECURITY

Effectiveness of the Civil Aviation Security program
[AD-A117671] N82-33362

SEDIMENTS

Hydrocarbon fuel chemistry: Sediment water
interaction
[AD-A117928] N82-33552

SEPARATED FLOW

An asymptotic theory of separated flow past
low-aspect-ratio wings
N82-46135

User's manual for interfacing a leading edge,
vortex rollup program with two linear panel
methods
[NASA-TN-78584] N82-33340

SHADOWGRAPH PHOTOGRAPHY

Shadowgraph techniques in transonic tests with
powered nacelles
N82-32674

SHALE OIL

An exploratory research and development program
leading to specifications for aviation turbine
fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551

SHEAR CREEP

Commercial aircraft airframe fuel systems survey
and analysis
[DOT/FAA/CT-82/80] N82-32351

SHEAR LAYERS

Supersonic jet noise generated by large scale
instabilities
[NASA-TP-2072] N82-34189

SHELL STABILITY

Calculation of the stability and post-buckling
behavior of thin shell underframes using the
finite element method --- German thesis
N82-45219

SHOCK WAVE INTERACTION

The effect of a weak shock wave on a wing of
complex planform at supersonic velocities
N82-46132

SHOCK WAVES

Measurements of mean static pressure and far field
acoustics of shock containing supersonic jets
[NASA-TN-84521] N82-33150

SHORT HAUL AIRCRAFT

Static investigation of the circulation control
wing/upper surface blowing concept applied to
the quiet short haul research aircraft
[NASA-TN-84232] N82-32343

SHORT TAKEOFF AIRCRAFT

High pressure bleed for STOL and STO-VL
performance: A conceptual examination
[AD-A115762] N82-32357
Analysis of several glidepath and speed control
autopilot concepts for a powered lift STOL
aircraft
[NASA-TN-84282] N82-33400

SHROUDS

Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366

SIGNAL PROCESSING

Reliability and maintainability improvement
program for the AV-8A/TAV-8A Harrier head-up
display set, development of the signal data
converter, CV-3600/AVQ-30(V), volume 3
[AD-A115554] N82-32365
Modeling of a tracking radar in terms of a
nonlinear second order phase lock loop
[AD-A115628] N82-32580

SIGNAL REFLECTION

L-band DME multipath environment in the Microwave
Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330

SIMILARITY THEOREM

Acoustic similarity laws for centrifugal fans
[ESA-TT-712] N82-33172

SIMULATION

A simulation language approach to structural
interaction problems
N82-33758

SITE SELECTION

Considerations for optimum siting of NEXRAD to
detect convective phenomena hazardous to
terminal air navigation, part 1 ---
meteorological radar
[DOT/FAA/RD-82/56] N82-32329

SKIN (STRUCTURAL MEMBER)

Prediction of fatigue crack propagation in plane
specimens and thin-walled structural elements of
aircraft wing skin under programmed loading
N82-47229

SLOPES

TRACALS evaluation report. Special report: A
procedure for RTT position improvement using
linear regression analysis of glide slope
structure
[AD-A115926] N82-33365
Family of airfoil shapes for rotating blades ---
for increased power efficiency and blade stability
[NASA-CASE-LAR-12843-1] N82-33372

SMOKE

Assessment of burning characteristics of aircraft
interior materials
[NASA-CR-166390] N82-32899

SODAR

Low level wind shear detection system for airport
landing approach areas using the Bertin Doppler
acoustic sounder /Sodar/
N82-45816

SOLAR ARRAYS

Phoenix airport solar photovoltaic concentrator
project
N82-44940

SOLAR POWERED AIRCRAFT

Some design considerations for solar-powered
aircraft
[NASA-TP-1675] N82-32350

SOLAR PROPULSION

SUBJECT INDEX

SOLAR PROPULSION

Some design considerations for solar-powered aircraft
[NASA-TP-1675] N82-32350

SOLVENT REFINED COAL
Performance of SRC II fuels in gas-turbine combustors. Alternative-fuels-utilization program [DE82-010471] N82-32518

SONIC NOZZLES
Heat transfer from nozzles under the conditions of flow laminarization
A82-46831

SOOT
Predictive model for jet engine test cell opacity [AD-A117585] N82-33397

SOUND LOCALIZATION
Study of the source function by the causality methods defined by Ribner and Siddon [PB82-205170] N82-34196

SOUND PRESSURE
USAF bioenvironmental noise data handbook. Volume 158: F-106A aircraft, near and far-field noise [AD-A116930] N82-33168

SOUND TRANSMISSION
Sound transmission through ducts and aircraft noise prediction, volume 1 [AD-A115783] N82-33164

SPACE ENVIRONMENT SIMULATION
Diffuser/ejector system for a very high vacuum environment [NASA-CASE-NPS-15791-1] N82-33712

SPACE EXPLORATION
Aeronautics and space report of the President: 1981 activities [NASA-TM-84719] N82-33332

SPACE PROGRAMS
Aeronautics and space report of the President: 1981 activities [NASA-TM-84719] N82-33332

SPACECRAFT PROPULSION
The technology of the assembly of engines for flight vehicles --- Russian book
A82-45765

SPARE PARTS
Palm's theorem for nonstationary processes [AD-A117089] N82-34135

SPECTRUM ANALYSIS
Maximum-entropy spectral analysis of radar clutter
A82-47407

SPEED CONTROL
Analysis of several glidepath and speed control autopilot concepts for a powered lift STOL aircraft [NASA-TM-84282] N82-33400

STABILITY
Labyrinth seal effects on rotor bearing system stability [AD-A116774] N82-32742

STABILITY AUGMENTATION
Development of a low risk augmentation system for an energy efficient transport having relaxed static stability [NASA-CR-159166] N82-32377

STABILITY DERIVATIVES
Application of Kalman filtering technique to aerodynamic derivatives for a helicopter
A82-45189

Two-dimensional apparent masses for cross-flow sections of wing-store configurations
A82-46801

Toward a better understanding of helicopter stability derivatives [NASA-TM-84277] N82-32376

STANDARDS
Development of avionics installation interface standards [AD-A116853] N82-33384

STANDING WAVES
Circumferentially segmented duct lines optimized for axisymmetric and standing wave sources --- reducing noise from turbofan engines galerkin method acoustic attenuation [NASA-TP-2075] N82-34190

STATE VECTORS
Design of analytical failure detection using secondary observers [NASA-TM-84284] N82-32362

STATIC AERODYNAMIC CHARACTERISTICS

Static investigation of the circulation control wing/upper surface blowing concept applied to the quiet short haul research aircraft [NASA-TM-84232] N82-32343

STATIC STABILITY
Active control technology in aircraft
N82-32303

Development of a low risk augmentation system for an energy efficient transport having relaxed static stability [NASA-CR-159166] N82-32377

Development of methods for assessment of gliding parachute applications [AD-A117103] N82-33356

STATIC BLADES
Engine dynamic analysis with general nonlinear finite element codes. Part 2: Bearing element implementation overall numerical characteristics and benchmarking [NASA-CR-167944] N82-33390

STATORS
Status of laser anemometry in turbomachinery research at the Lewis Research Center
N82-32686

STOCHASTIC PROCESSES
Implementable differential equations for nonlinear filtering --- radar tracking [NLR-MP-81037 U] N82-33120

Palm's theorem for nonstationary processes [AD-A117089] N82-34135

STORAGE TANKS
Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California [AD-A117875] N82-33554

STRESS (PSYCHOLOGY)
The determination of the duration of an exposure to aircraft noise --- German thesis
A82-45221

STRESS-STRAIN RELATIONSHIPS
Nonlinear constitutive theory for turbine engine structural analysis
N82-33744

STRUCTURAL ANALYSIS
Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method --- German thesis
A82-45219

Development of a Structural Integrity Recording System (SIRS) for US Army AH-1S helicopters [AD-A116027] N82-32364

Nonlinear constitutive theory for turbine engine structural analysis
N82-33744

STRUCTURAL DESIGN
Design of helicopter rotor blades for optimum dynamic characteristics [NASA-CR-169352] N82-33374

STRUCTURAL DESIGN CRITERIA
Honeycomb cored structures --- Russian book on aircraft construction materials
A82-45775

STRUCTURAL STABILITY
Fundamentals of strength and aeroelasticity in flight vehicles --- Russian book
A82-45762

STRUCTURAL STRAIN
A simulation language approach to structural interaction problems
N82-33758

STRUCTURAL VIBRATION
Helicopter vibration suppression using simple pendulum absorbers on the rotor blade [NASA-CR-3619] N82-33734

STRUCTS
Energy efficient engine: Turbine transition duct model technology report [NASA-CR-167996] N82-33394

STURM-LIOUVILLE THEORY
An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method --- for computer aided design and manufacturing
A82-46628

SUBSTITUTES
Replacement of aboard naval aircraft [AD-A115782] N82-32356

SUPERCRITICAL WINGS
Measured and calculated effects of angle of attack on the transonic flutter of a supercritical wing [NASA-TM-83276] N82-33736

SUPERSONIC CRUISE AIRCRAFT RESEARCH
Langley test highlights, 1981 [NASA-TM-84519] N82-33330

SUPERSONIC FLIGHT
Measurements of mean static pressure and far field acoustics of shock containing supersonic jets [NASA-TM-84521] N82-33150

SUPERSONIC FLOW
The effect of a weak shock wave on a wing of complex planform at supersonic velocities N82-46132
Investigation of the aerodynamics of axisymmetric bodies in supersonic flow in the presence of localized injection N82-46692

SUPERSONIC JET FLOW
Supersonic jet noise generated by large scale instabilities [NASA-TP-2072] N82-34189

SUPERSONIC WIND TUNNELS
Operational flow visualization techniques in the Langley Unitary Plan Wind Tunnel N82-32671
LV measurements with an advanced turboprop N82-32690

SURFACE PROPERTIES
Surface flow visualization requirements for testing in NTP N82-32667

SURFACE ROUGHNESS
Operational evaluation of a propeller test stand in the quiet flow facility at Langley Research Center [NASA-TM-84523] N82-33149

SWEEP WINGS
Nonlinear transonic flutter analysis [AIAA PAPER 81-0608] N82-46847

SYNOPTIC METEOROLOGY
Post analysis of aircraft accident environments N82-45835

SYSTEMS ANALYSIS
Optimization of dispatching discipline in queueing systems with limited queues N82-46607
Executive summary of systems analysis to develop future civil aircraft noise reduction alternatives [AD-A116467] N82-33162

SYSTEMS INTEGRATION
Aircraft meteorological data relay /ANDAR/ N82-45822

T

TAIL ASSEMBLIES
Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel [NASA-TP-2043] N82-32320
Langley test highlights, 1981 [NASA-TM-84519] N82-33330

TAKEOFF
Wind determination and wind shear detection from flight test and airline flight data N82-45815
Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system [AD-A117141] N82-33407

TAPERING
Analysis of tapered-land hybrid aerostatic journal bearings N82-47944
The aerodynamic influences of rotor blade taper, twist, airfoils and solidity on hover and forward flight performance [AD-A117397] N82-33357

TARGET ACQUISITION
Attribute requirements for a simulated flight scenario microcomputer test [AD-A115676] N82-32389
Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload [AD-A117877] N82-33379

TARGET RECOGNITION
Preliminary assessment of US Coast Guard Short Range Recovery (SRR) Forward Looking Infrared (FLIR) system small target detection performance [AD-A117916] N82-34230

TECHNOLOGICAL FORECASTING
Aviation meteorology in the 1980's - A trend forecast N82-45827
Scenarios of economic development within the European community up to the year 2000 [ESA-TT-730] N82-33286

TECHNOLOGY ASSESSMENT
The technology of the assembly of engines for flight vehicles --- Russian book N82-45765
The choice of technology for ATC radars. I - Transmitters N82-45981
Evaluation of noise control technology and alternative noise certification procedures for propeller-driven small airplanes [AD-A116495] N82-33151

TELECOMMUNICATION
Aeronautics and space report of the President: 1981 activities [NASA-TM-84719] N82-33332

TERMINAL FACILITIES
Terminal Information Processing System (TIPS) Consolidated CAB Display (CCD) comparative analysis [FAA-CT-81-8] N82-32331
Study of the frequency assignment congestion in the ultra high frequency air traffic control air/ground communication band [AD-A117640] N82-33368

TERMINAL GUIDANCE
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978 [ESA-TT-739] N82-32338
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 3, 1979 [ESA-TT-740] N82-32339

TERRAIN FOLLOWING AIRCRAFT
The development of terrain following displays for the Tornado aircraft [REPT-200] N82-32337
Terrain following/terrain avoidance system concept development N82-33363

TEST EQUIPMENT
Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans [NASA-CR-167928-VOL-1] N82-32370
USAF bioenvironmental noise data handbook. Volume 168: MB-3 tester, pressurized cabin leakage, aircraft [AD-A116153] N82-33163

TEST STANDS
China's newly designed and built aircraft engine test stand [AD-A117569] N82-33410

THEOREMS
Palm's theorem for nonstationary processes [AD-A117089] N82-34135

THERMAL FATIGUE
Modeling of thermal effects when investigating the thermal fatigue life of the blades of a gas-turbine engine N82-46832

THERMAL SIMULATION
Modeling of thermal effects when investigating the thermal fatigue life of the blades of a gas-turbine engine N82-46832

THERMAL STRESSES
Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating N82-46617

THIS WALLED SHELLS

SUBJECT INDEX

THIS WALLED SHELLS

Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method --- German thesis
A82-45219

THIN WINGS

Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608]
A82-46847

THREE DIMENSIONAL BOUNDARY LAYER

The effect of heat transfer on three-dimensional spatial stability and transition of flat plate boundary layer at Mach 3
A82-45877

THREE DIMENSIONAL FLOW

Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
A82-45188

Computer prediction of three-dimensional potential flow fields in which aircraft propellers operate
[NASA-CR-169317]
N82-32312

Computation of three dimensional unsteady nonuniform flow in the blade-free annular channel of a turbomachine --- military aircraft, turbocompressors
[ONERA-NT-1982-2]
N82-32372

THRUST

An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist
A82-46140

THRUST AUGMENTATION

RSRA vertical drag test report --- rotor systems research aircraft
[NASA-CR-166399]
N82-32341

THRUST REVERSAL

Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel
[NASA-TP-2043]
N82-32320

THRUST VECTOR CONTROL

High pressure bleed for STOL and STO-VL performance: A conceptual examination
[AD-A115762]
N82-32357

THUNDERSTORMS

Mesoscale convective complexes and general aviation
A82-45832

TIME DEPENDENCE

System optimization by periodic control
[AD-A117815]
N82-33402

TOMOGRAPHY

Determination of material properties by limited scan X-ray tomography
[AD-A116670]
N82-32422

Holographic interferometry and tomography at Ames Research Center
N82-32681

TORQUE

Operational evaluation of a propeller test stand in the quiet flow facility at Langley Research Center
[NASA-TM-84523]
N82-33149

TOXICITY

Assessment of burning characteristics of aircraft interior materials
[NASA-CR-166390]
N82-32899

TRACKING FILTERS

Altitude estimation using asynchronous alpha-beta tracking filters
A82-46387

TRAINING ANALYSIS

Chief of Naval Air Training automated management information system (CANIS) users guide
[AD-A115852]
N82-33280

TRAINING EVALUATION

Chief of Naval Air Training automated management information system (CANIS) users guide
[AD-A115852]
N82-33280

An Operational evaluation of head up displays for civil transport operations. NASA/FAA phase 3 report
[NASA-TP-1815]
N82-33381

TRANSCONTINENTAL SYSTEMS

Aircraft meteorological data relay /AMDAR/
A82-45822

TRANSMISSIONS (MACHINE ELEMENTS)

Kinematic precision of gear trains
[NASA-TM-82887]
N82-32733

TRANSONIC FLOW

Finite difference modeling of rotor flows including wake effects
[NASA-TM-84280]
N82-33345

Recent applications of the transonic wing analysis computer code, TWING
[NASA-TM-84283]
N82-33346

TRANSONIC FLUTTER

Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608]
A82-46847

The Shock and Vibration Digest, volume 14, no. 7
[AD-A117323]
N82-32301

Measured and calculated effects of angle of attack on the transonic flutter of a supercritical wing
[NASA-TM-83276]
N82-33736

TRANSONIC SPEED

Effect of nozzle and vertical-tail variables on the performance of a 3-surface F-15 model at transonic Mach numbers --- Langley 16 foot transonic tunnel
[NASA-TP-2043]
N82-32320

TRANSONIC WIND TUNNELS

Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels
[NASA-TM-84847]
N82-32384

Surface flow visualization requirements for testing in NTF
N82-32667

Shadowgraph techniques in transonic tests with powered nacelles
N82-32674

Transonic applications of the Wake Imaging System
N82-32676

Flow visualization in the Langley 0.3-meter Transonic Cryogenic Tunnel and preliminary plans for the National Transonic Facility
N82-32677

Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel
N82-32678

Development of a laser velocimeter for a large transonic wind tunnel
N82-32688

Seeding considerations for an LV system in a large transonic wind tunnel
N82-32689

Laser Doppler velocimetry application in the Langley 0.3-meter Transonic Cryogenic Tunnel
N82-32696

Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer
N82-32697

Some NTF laser velocimeter installation and operation considerations
N82-32698

Cryogenic wind tunnels: A selected, annotated bibliography
[NASA-TM-84474]
N82-33405

TRANSPORT AIRCRAFT

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Initial ACT configuration design study
[NASA-CR-3304]
N82-32349

Integrative application of active controls (IAAC) technology to an advanced subsonic transport project. Initial act configuration design study
[NASA-CR-159249]
N82-32380

Integrated application of active controls (IAAC) technology to an advanced subsonic transport project. Conventional baseline configuration study
[NASA-CR-159248]
N82-32381

Environmental exposure effects on composite materials for commercial aircraft
[NASA-CR-165981]
N82-32421

Scenarios of economic development within the European community up to the year 2000
[ESA-TT-730]
N82-33286

TRANSVERSE WAVES

Transverse electric waves for VLF/LF communication between aircraft
[AD-A115834]
N82-32582

TRITIUM

Testing of tritium-powered runway distance and taxiway markers
[AD-A114558]
N82-33408

SUBJECT INDEX

VIBRATION TESTS

TURBINE ENGINES

Energy efficient engine; High pressure turbine
uncooled rig technology report
[NASA-CR-165149] N82-32383

TURBINES

The CP6 jet engine performance improvement: Low
pressure turbine active clearance control
[NASA-CR-165557] N82-33393

TURBOCOMPRESSORS

Numerical calculation of the flow in compressor
and turbine cascades --- German thesis
A82-45222

Computation of three dimensional unsteady
nonuniform flow in the blade-free annular
channel of a turbomachine --- military aircraft,
turbocompressors
[ONERA-NT-1982-2] N82-32372

TURBOFAN ENGINES

Integrated airframe propulsion control
[NASA-CR-3606] N82-32382

Automated procedure for developing hybrid computer
simulations of turbofan engines. Part 1:
General description
[NASA-TP-1851] N82-33020

The CP6 jet engine performance improvement: Low
pressure turbine active clearance control
[NASA-CR-165557] N82-33393

Circumferentially segmented duct lines optimized
for axisymmetric and standing wave sources ---
reducing noise from turbofan engines galerkin
method acoustic attenuation
[NASA-TP-2075] N82-34190

TURBOMACHINE BLADES

Numerical calculation of the flow in compressor
and turbine cascades --- German thesis
A82-45222

Modeling of thermal effects when investigating the
thermal fatigue life of the blades of a
gas-turbine engine
A82-46832

TURBOMACHINERY

The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

Subsynchronous vibrations of rotor systems
N82-32528

TURBOPROP AIRCRAFT

Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370

TURBOPROP ENGINES

Exterior noise on the fuselage of light propeller
driven aircraft in flight
A82-46114

Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370

Advanced turboprop testbed systems study
[NASA-CR-167895] N82-33375

Ceramic gas turbine engine demonstration program
[AD-A117088] N82-33395

TURBING FLIGHT

Observability of the parameters of an inertial
navigation system for a 360-deg coordinated turn
A82-47093

TWISTED WINGS

The aerodynamic influences of rotor blade taper,
twist, airfoils and solidity on hover and
forward flight performance
[AD-A117397] N82-33357

TWO DIMENSIONAL FLOW

Application of a transonic similarity rule to
correct the effects of sidewall boundary layers
in two-dimensional transonic wind tunnels
[NASA-TN-84847] N82-32384

U

ULTRAHIGH FREQUENCIES

Study of the frequency assignment congestion in
the ultra high frequency air traffic control
air/ground communication band
[AD-A117640] N82-33368

UNDERGROUND STORAGE

Vapor condensation control of JP-4 emissions from
underground storage tanks at March Air Force
Base, California
[AD-A117875] N82-33554

UNIVERSITY PROGRAM

USAF Summer Faculty Research Program. Volume 1:
1981 research reports
[AD-A113708] N82-34340

USAF Summer Faculty Research Program. Volume 2:
1981 research reports
[AD-A113709] N82-34341

UNSTEADY FLOW

Study on pressure distribution on rotor blades
with three-dimensional nonsteady theory of
compressible fluid
A82-45188

Computation of three dimensional unsteady
nonuniform flow in the blade-free annular
channel of a turbomachine --- military aircraft,
turbocompressors
[ONERA-NT-1982-2] N82-32372

UPLINKING

Efficient transfer of weather information to the
pilot in flight
[NASA-CR-165889] N82-32363

UPPER SURFACE BLOWING

Static investigation of the circulation control
wing/upper surface blowing concept applied to
the quiet short haul research aircraft
[NASA-TN-84232] N82-32343

USER MANUALS (COMPUTER PROGRAMS)

A computer program for the prediction of near
field noise of aircraft in cruising flight:
User's guide
[NASA-CR-159274] N82-33148

Chief of Naval Air Training automated management
information system (CANIS) users guide
[AD-A115852] N82-33280

User's manual for interfacing a leading edge,
vortex rollup program with two linear panel
methods
[NASA-TN-78584] N82-33340

USER REQUIREMENTS

Terminal Information Processing System (TIPS)
Consolidated CAB Display (CCD) comparative
analysis
[FAA-CT-81-8] N82-32331

V

V/STOL AIRCRAFT

Recent progress in VSTOL technology
[NASA-TN-84238] N82-33334

VACUUM FURNACES

Selected furnace brazed components for the
aerospace industry
A82-46529

VAPORS

Vapor condensation control of JP-4 emissions from
underground storage tanks at March Air Force
Base, California
[AD-A117875] N82-33554

VARIABLE GEOMETRY STRUCTURES

Integral characteristics in the computer-aided
design of geometrical objects of complex
configuration
A82-46603

VERBAL COMMUNICATION

Aircraft alerting systems standardization study.
Phase 4: Accident implications on systems design
[AD-A117876] N82-33388

VIBRATION

The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

Subsynchronous vibrations of rotor systems
N82-32528

VIBRATION ISOLATORS

Decoupler pylon: wing/store flutter suppressor
[NASA-CASE-LAB-12468-1] N82-32373

Helicopter vibration suppression using simple
pendulum absorbers on the rotor blade
[NASA-CR-3619] N82-33734

VIBRATION TESTS

A random vibration test for the evaluation of
stiff sensitive component parts
A82-47073

VIDEO EQUIPMENT

VIDEO EQUIPMENT

- Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676] N82-32389
- A color video display technique for flow field surveys
N82-32669
- VIEWING**
Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel
N82-32678
- VISCOPLASTICITY**
Nonlinear constitutive theory for turbine engine structural analysis
N82-33744
- VISCOUS DRAG**
NASA research on viscous drag reduction [NASA-TN-84518] N82-33344
- VISIBILITY**
Development and test of a tactical visibility sensor
A82-45820
- Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel
N82-32678
- VISION**
Operational flow visualization techniques in the Langley Unitary Plan Wind Tunnel
N82-32671
- Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407
- VOICE COMMUNICATION**
Voice Interactive Systems Technology Avionics (VISTA) Program
[AD-A117288] N82-33383
- VOLATILITY**
Assessment of burning characteristics of aircraft interior materials
[NASA-CR-166390] N82-32899
- VORTICES**
User's manual for interfacing a leading edge, vortex rollup program with two linear panel methods
[NASA-TN-78584] N82-33340
- VORTICITY**
A study of wing vorticity patterns
A82-46621
- VULNERABILITY**
Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877] N82-33379

W

WAKES

- Finite difference modeling of rotor flows including wake effects
[NASA-TN-84280] N82-33345

WALL FLOW

- Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels
[NASA-TN-84847] N82-32384

WARNING SYSTEMS

- Pitts' principles still applicable - Computer monitoring of fighter aircraft emergencies
A82-46254
- The performance of warning systems in avoiding Controlled-Flight-Into-Terrain /CFIT/ accidents
A82-46255
- Aircraft alerting systems standardization study. Phase 4: Accident implications on systems design
[AD-A117876] N82-33388

WATER

- Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928] N82-33552

WATER WAVES

- Two-frequency J. W. Johnson, W. L. Jones
A82-47493
- A comparison of Seasat-derived wave height with surface data
A82-47496

WAVE PROPAGATION

- The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

SUBJECT INDEX

WAVEFORMS

- Reliability and maintainability improvement program for the AV-8A/TAV-8A Harrier head-up display set, development of the signal data converter, CV-3600/AVQ-30 (V), volume 3
[AD-A115554] N82-32365

WEAPON SYSTEMS

- Maintenance support resource forecasting models. Volume 2: Equivalence testing of reliability and maintenance model and expected values model
[AD-A117149] N82-32307
- Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117141] N82-33407

WEATHER

- Testing of tritium-powered runway distance and taxiway markers
[AD-A114558] N82-33408

WEATHER FORECASTING

- A modular automated approach to airfield weather systems
A82-45813
- Turbulence and wind shear experiments related to aircraft operation in the terminal area
A82-45817
- Aspects of clear air turbulence severity forecasting and detection
A82-45823
- The WSI real-time aviation weather information system - An alternative to standard general aviation weather briefing procedures
A82-45834

- Considerations for optimum siting of NEXRAD to detect convective phenomena hazardous to terminal air navigation, part 1 --- meteorological radar
[DOT/FAA/RD-82/56] N82-32329
- Efficient transfer of weather information to the pilot in flight
[NASA-CR-165889] N82-32363

WEATHER STATIONS

- Automated Low-cost Weather Observation System (ALWOS)
[AD-A117447] N82-33954

WEIGHT MEASUREMENT

- Assessment of burning characteristics of aircraft interior materials
[NASA-CR-166390] N82-32899

WEIGHTING FUNCTIONS

- Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing
A82-46608

WELDED JOINTS

- A review of the history of nondestructive testing in Japan
A82-48257

WHEELS

- BSRA vertical drag test report --- rotor systems research aircraft
[NASA-CR-166399] N82-32341

WIND DIRECTION

- Wind determination and wind shear detection from flight test and airline flight data
A82-45815

WIND EFFECTS

- The Shock and Vibration Digest, volume 14, no. 7
[AD-A117323] N82-32301

WIND MEASUREMENT

- Aspects of clear air turbulence severity forecasting and detection
A82-45823

WIND SHEAR

- Wind determination and wind shear detection from flight test and airline flight data
A82-45815
- Low level wind shear detection system for airport landing approach areas using the Bertin Doppler acoustic sounder /Sodar/
A82-45816
- Turbulence and wind shear experiments related to aircraft operation in the terminal area
A82-45817
- Heavy rain/wind shear accidents
A82-45825

SUBJECT INDEX

X RAY INSPECTION

Considerations for optimum siting of NEXRAD to detect convective phenomena hazardous to terminal air navigation, part 1 --- meteorological radar [DOT/FAA/BD-82/56] N82-32329

WIND TUNNEL APPARATUS
Transonic applications of the Wake Imaging System N82-32676

Flow visualization in the Langley 0.3-meter Transonic Cryogenic Tunnel and preliminary plans for the National Transonic Facility N82-32677

WIND TUNNEL MODELS
Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel N82-32678

Cryogenic wind tunnels: A selected, annotated bibliography [NASA-TN-84474] N82-33405

WIND TUNNEL WALLS
Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels [NASA-TN-84847] N82-32384

WIND TUNNELS
Applications of a laser velocimeter in the Langley 4- by 7-meter tunnel N82-32693

Noise measurement in wind tunnels, workshop summary [NASA-TN-84219] N82-34188

WIND VELOCITY
Wind determination and wind shear detection from flight test and airline flight data A82-45815

WING LOADING
Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747 [NASA-CR-3164] N82-32346

WING NACELLE CONFIGURATIONS
Selected winglet and mixed flow long duct nacelle development for DC-10 derivative aircraft [NASA-CR-3296] N82-32347

WING OSCILLATIONS
Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing A82-46608

The effect of a screen on the aerodynamic characteristics of an oscillating profile A82-46693

WING PANELS
User's manual for interfacing a leading edge, vortex rollup program with two linear panel methods [NASA-TN-78584] N82-33340

WING PLANFORMS
The effect of a weak shock wave on a wing of complex planform at supersonic velocities A82-46132

WING PROFILES
Application of an optimized winglet configuration to an advanced commercial transport [NASA-CR-159156] N82-32348

WING TIPS
Selected advanced aerodynamics and active controls technology concepts development on a derivative B-747 [NASA-CR-3164] N82-32346

WING-FUSELAGE STORES
Self-tuning regulator design for adaptive control of aircraft wing/store flutter A82-45538

Two-dimensional apparent masses for cross-flow sections of wing-store configurations A82-46801

WINGLETS
Selected winglet and mixed flow long duct nacelle development for DC-10 derivative aircraft [NASA-CR-3296] N82-32347

Application of an optimized winglet configuration to an advanced commercial transport [NASA-CR-159156] N82-32348

WINGS
A study of wing vorticity patterns A82-46621

Prediction of fatigue crack propagation in plane specimens and thin-walled structural elements of aircraft wing skin under programmed loading A82-47229

Investigation of the interference effects of mixed flow long duct nacelles on a DC-10 wing [NASA-CR-159202] N82-32319

Decoupler pylon: wing/store flutter suppressor [NASA-CASE-LAR-12468-1] N82-32373

A color video display technique for flow field surveys N82-32669

Langley test highlights, 1981 [NASA-TN-84519] N82-33330

X

X RAY INSPECTION

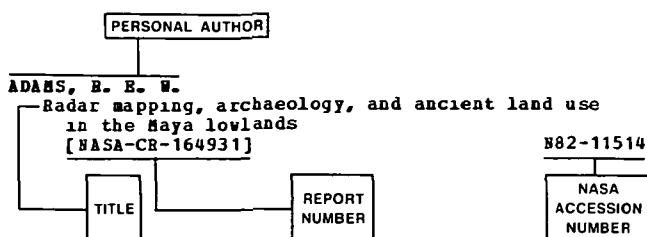
Determination of material properties by limited scan X-ray tomography [AD-A116670] N82-32422

PERSONAL AUTHOR INDEX

AERONAUTICAL ENGINEERING / A Continuing Bibliography (Suppl. 156)

JANUARY 1983

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report translation, NASA contractor report). The accession number is located beneath and to the right of the title, e.g., N82-11514. Under any one author's name the accession numbers are arranged in sequence with the IAA accession numbers appearing first.

A

- ADAM, C. P.**
Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355
- ADAMS, R. E. W.**
Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390
- AKHATOV, R. KH.**
Integral characteristics in the computer-aided
design of geometrical objects of complex
configuration
N82-46603
- ALGAZIN, V. A.**
The effect of a screen on the aerodynamic
characteristics of an oscillating profile
N82-46693
- ALLISON, D.**
Automation in the skies
N82-47224
- AMLICK, B. B.**
A-7 flight software analysis
[AD-A116179] N82-32386
- ANTONOV, V. A.**
Investigation of the aerodynamics of axisymmetric
bodies in supersonic flow in the presence of
localized injection
N82-46692
- ATCHISON, V. L.**
Speech Command Auditory Display System (SCADS)
[AD-A117486] N82-33387

B

- BADEHORST, J. J.**
Computational aerodynamics
N82-45851
- BALLHAUS, W. F., JR.**
Computational aerodynamics and design
[NASA-TN-84257] N82-33348
- BARE, E. A.**
Effect of nozzle and vertical-tail variables on
the performance of a 3-surface F-15 model at
transonic Mach numbers
[NASA-TP-2043] N82-32320
- BARON, A. R.**
Passive direction finding and signal location
N82-45346

- BARSIKOW, B.**
Acoustic similarity laws for centrifugal fans
[ESA-TT-712] N82-33172
- BAUCHSPIES, J.**
Aircraft energy conservation during airport ground
operations
[AD-A116138] N82-32352
- BAYLISS, A.**
Simulation of the fluctuating field of a forced jet
[NASA-TN-84506] N82-34191
- BECK, B. D.**
The CP6 jet engine performance improvement: Low
pressure turbine active clearance control
[NASA-CR-165557] N82-33393
- BENDA, L.**
Exterior noise on the fuselage of light propeller
driven aircraft in flight
N82-46114
- BENGELINK, R. L.**
Surface flow visualization requirements for
testing in NTF
N82-32667
- BERG, R. A.**
Development of a low risk augmentation system for
an energy efficient transport having relaxed
static stability
[NASA-CR-159166] N82-32377
- BERRY, V. L.**
Crashworthy airframe design concepts: Fabrication
and testing
[NASA-CR-3603] N82-33735
- BERSON, B. L.**
Aircraft alerting systems standardization study.
Phase 4: Accident implications on systems design
[AD-A117876] N82-33388
- BINGHAM, G. J.**
The aerodynamic influences of rotor blade taper,
twist, airfoils and solidity on hover and
forward flight performance
[AD-A117397] N82-33357
- BLACK, S. B.**
Integrated airframe propulsion control
[NASA-CR-3606] N82-32382
- BLOCK, P. J. W.**
Operational evaluation of a propeller test stand
in the quiet flow facility at Langley Research
Center
[NASA-TN-84523] N82-33149
- BLOM, H. A. P.**
Implementable differential equations for nonlinear
filtering
[NLR-MP-81037 U] N82-33120
- BORLAND, C. J.**
Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608] N82-46847
- BRADLEY, E. S.**
Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370
- BRAUN, A.**
A comparison of Seasat-derived wave height with
surface data
N82-47496
- BRAY, R. S.**
An Operational evaluation of head up displays for
civil transport operations. NASA/FAA phase 3
report
[NASA-TP-1815] N82-33381
- BROBLEY, E., JR.**
Aviation meteorology in the 1980's - A trend
forecast
N82-45827

BROWSON, C. E., JR.
 Multibody aircraft study, volume 1
 [NASA-CR-165829-VOL-1] N82-32344
 Multibody aircraft study, volume 2
 [NASA-CR-165829-VOL-2] N82-32345

BROSSIER, C.
 A comparison of Seasat-derived wave height with
 surface data A82-47496

BROWN, D.
 Evaluation of noise control technology and
 alternative noise certification procedures for
 propeller-driven small airplanes
 [AD-A116495] N82-33151

BROWN, J. A.
 Climatic laboratory evaluation YCH-47D helicopter
 [AD-A115861] N82-32355

BROWN, K. W.
 Structural tailoring of engine blades (STAEBL)
 [NASA-CR-167949] N82-33391

BRUTON, W. M.
 Automated procedure for developing hybrid computer
 simulations of turbofan engines. Part 1:
 General description
 [NASA-TP-1851] N82-33020

BRY, P.
 Computation of three dimensional unsteady
 nonuniform flow in the blade-free annular
 channel of a turbomachine
 [ONERA-MT-1982-2] N82-32372

BURNER, A. W.
 Seeing through flows in Langley's 0.3-meter
 Transonic Cryogenic Tunnel N82-32678

Flow field studies using holographic
 interferometry at Langley N82-32682

C

CALE, R. E.
 Post analysis of aircraft accident environments
 A82-45835

CARADONNA, P. X.
 Finite difference modeling of rotor flows
 including wake effects
 [NASA-TM-84280] N82-33345

CARNICHAEL, M. D.
 Reliability and maintainability improvement
 program for the AV-8A/TAV-8A Harrier head-up
 display set, development of the signal data
 converter, CV-3600/AVQ-30(V), volume 3
 [AD-A115554] N82-32365

CARR, L. W.
 An experimental study of dynamic stall on advanced
 airfoil sections. Volume 1: Summary of the
 experiment
 [NASA-TM-84245] N82-32314

CARTER, P.
 FAA air traffic activity, FY 1981
 [PB82-200361] N82-33371

CASE, F. M.
 Testing of tritium-powered runway distance and
 taxiway markers
 [AD-A114558] N82-33408

CHAUSONET, J.
 Airbus industrie and community noise
 A82-45845

CHIKOS, S. P.
 Aircraft alerting systems standardization study.
 Phase 4: Accident implications on systems design
 [AD-A117876] N82-33388

CHISHOLE, D. A.
 A modular automated approach to airfield weather
 systems A82-45813

A tower approach to slant visual range observation
 and prediction A82-45818

CHISHOV, V. M.
 Fundamentals of strength and aeroelasticity in
 flight vehicles A82-45762

CHOPRA, I.
 Aeroelastic stability of rotor blades using finite
 element analysis
 [NASA-CR-166389] N82-32342

CHUANG, C. D.
 Geodesic paths of an ellipsoid-mounted antenna
 [AD-A116453] N82-32573

CLARK, K. G.
 Replacement of aboard naval aircraft
 [AD-A115782] N82-32356

COLE, H. W.
 The choice of technology for ATC radars. I -
 Transmitters A82-45981

CORLETT, W. A.
 Operational flow visualization techniques in the
 Langley Unitary Plan Wind Tunnel N82-32671

COSTELLO, P.
 Aircraft energy conservation during airport ground
 operations
 [AD-A116138] N82-32352

COTE, S. M.
 Survey and update of F-14A mission profiles for
 TF30 engine usage
 [AD-A116831] N82-33337

COTTONE, L. C.
 Vapor condensation control of JP-4 emissions from
 underground storage tanks at March Air Force
 Base, California
 [AD-A117875] N82-33554

COULSON, C. E.
 Active clearance control system for a turbomachine
 [NASA-CASE-LEW-12938-1] N82-32366

COY, J. J.
 Kinematic precision of gear trains
 [NASA-TM-82887] N82-32733

CRAB, C. W.
 Study of the frequency assignment congestion in
 the ultra high frequency air traffic control
 air/ground communication band
 [AD-A117640] N82-33368

CRAVEN, E. P.
 Multibody aircraft study, volume 1
 [NASA-CR-165829-VOL-1] N82-32344
 Multibody aircraft study, volume 2
 [NASA-CR-165829-VOL-2] N82-32345

CRAWFORD, G. B.
 Palm's theorem for nonstationary processes
 [AD-A117089] N82-34135

CROWK, P. M.
 Modeling of a tracking radar in terms of a
 nonlinear second order phase lock loop
 [AD-A115628] N82-32580

CROMKHYTE, J. D.
 Crashworthy airframe design concepts: Fabrication
 and testing
 [NASA-CR-3603] N82-33735

CROWDER, J. P.
 In-flight propeller flow visualization using
 fluorescent minitufts N82-32673

Transonic applications of the Wake Imaging System
 N82-32676

CUNNINGGS, R. J.
 Investigation of aircrew protection during
 emergency escape at dynamic pressures up to 1600 g
 [AD-A117552] N82-33359

CURRIE, B. W.
 Maximum-entropy spectral analysis of radar clutter
 A82-47407

CUTCHINS, H. A.
 A simulation language approach to structural
 interaction problems N82-33758

CZEKALSKI, L.
 Terminal Information Processing System (TIPS)
 Consolidated CAB Display (CCD) comparative
 analysis
 [FAA-CT-81-8] N82-32331

D

DATKO, J. T.
 Sound transmission through ducts and aircraft
 noise prediction, volume 1
 [AD-A115783] N82-33164

DAVIES, J. M.
 The development of terrain following displays for
 the Tornado aircraft
 [REPT-200] N82-32337

DAVIS, K. P.
Passive direction finding and signal location
A82-45346

DECKER, R.
Aircraft meteorological data relay /AMDAR/
A82-45822

DECKERT, W. R.
Recent progress in VSTOL technology
[NASA-TM-84238] N82-33334

DEFUR, P. O.
Hydrocarbon fuel chemistry: Sediment water
interaction
[AD-A117928] N82-33552

DEHABEE, J.
Examination of aircraft interior emergency
lighting in a postcrash fire environment
[AD-A117629] N82-33360

DEHN, B. I.
Airfield construction - A reference book
A82-48264

DESILVA, B. M. E.
User's manual for interfacing a leading edge,
vortex rollup program with two linear panel
methods
[NASA-TM-78584] N82-33340

DESOPPER, A.
Finite difference modeling of rotor flows
including wake effects
[NASA-TM-84280] N82-33345

DIESBURG, D. E.
Carburized high temperature steels
[AD-A116559] N82-32467

DJORDJEVIC, S. Z.
The dynamic flexural response of propeller blades
[NASA-CR-169318] N82-32313

DONELSON, J. E.
Long duct nacelle aerodynamic development for
DC-10 derivatives
[NASA-CR-159271] N82-32315
Investigation of the interference effects of mixed
flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319

DOTSON, J. G.
Development of a Structural Integrity Recording
System (SIRS) for US Army AH-1S helicopters
[AD-A116027] N82-32364

DOTY, K.
Enhancements and algorithms for avionic
information processing system design methodology
[AD-A117948] N82-33385

DOVIK, R. J.
Considerations for optimum siting of NEXRAD to
detect convective phenomena hazardous to
terminal air navigation, part 1
[DOT/FAA/RD-82/56] N82-32329

E

EDGE, E. C.
Moisture gradient considerations in environmental
fatigue of CFRP
A82-45479

EDMONDS, J. D.
Northeast corridor helicopter area navigation
accuracy evaluation
[AD-A117445] N82-33367

EGOROV, V. P.
Airfield construction - A reference book
A82-48264

EHRENBERGER, L. J.
Aspects of clear air turbulence severity
forecasting and detection
A82-45823

ELLIOTT, J. W.
Applications of a laser velocimeter in the Langley
4- by 7-meter tunnel
N82-32693

ELTON, R. W.
Harpoon missile captive-carry dynamic environments
on the A-6E aircraft
A82-47072

EMERY, V. R.
Aerofstructure nondestructive evaluation by thermal
field detection, phase 1: Fundamental
information and basic technique development
[AD-A115724] N82-32425

ENDERS, J. B.
A safety appraisal of the air traffic control system
[AD-A115743] N82-33366

ENGLAR, R. J.
Static investigation of the circulation control
wing/upper surface blowing concept applied to
the quiet short haul research aircraft
[NASA-TM-84232] N82-32343

EPPEL, J. C.
Static investigation of the circulation control
wing/upper surface blowing concept applied to
the quiet short haul research aircraft
[NASA-TM-84232] N82-32343

ESSENHAW, R.
The Shock and Vibration Digest, volume 14, no. 7
[AD-A117323] N82-32301
The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525

EVANS, J. E.
L-band DME multipath environment in the Microwave
Landing System (MLS) approach and landing region
[FAA-RD-82-19] N82-32330

EVANS, W. K.
Alternative employment concepts for Remotely
Piloted Vehicle (RPV) FLIR/PV mission payload
[AD-A117877] N82-33379

EVSTIGNEEV, M. I.
The automation of processes for producing aircraft
engines /2nd revised and enlarged edition/
A82-45771

F

PAGE, J. H.
Low level wind shear detection system for airport
landing approach areas using the Bertin Doppler
acoustic sounder /Sodar/
A82-45816

FARNER, B. T.
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1] N82-32344
Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2] N82-32345

FARNER, M. G.
Measured and calculated effects of angle of attack
on the transonic flutter of a supercritical wing
[NASA-TM-83276] N82-33736

FASANELLA, E. L.
Results from tests of three prototype general
aviation seats
[NASA-TM-84533] N82-33733

FASCHING, W. A.
The CP6 jet engine performance improvement: Low
pressure turbine active clearance control
[NASA-CR-165557] N82-33393

FELDER, J.
Aircraft energy conservation during airport ground
operations
[AD-A116138] N82-32352

FENNEL, R. E.
Integrated airframe propulsion control
[NASA-CR-3606] N82-32382

FERTIS, J.
Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390

FIELD, E. C., JR.
Transverse electric waves for VLF/LF communication
between aircraft
[AD-A115834] N82-32582

FLENNING, R. J.
RSRA vertical drag test report
[NASA-CR-166399] N82-32341

FLYNN, D. J.
An investigation of ring laser gyroscope random
walk experiments
A82-47157

FOOTE, R.
Reliability, Availability, Maintainability Data
Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378

FORREST, R. D.
A ground-simulator investigation of helicopter
longitudinal flying qualities for instrument
approach
[NASA-TM-84225] N82-33398

FOX, J. C.
A-7 flight software analysis
[AD-A116179] N82-32386

FREEDMAN, R. J.
Seeding considerations for an LV system in a large
transonic wind tunnel N82-32689

FRITSCH, J. H.
Mesoscale convective complexes and general aviation
A82-45832

FULLER, L. C.
Replacement of aboard naval aircraft
[AD-A115782] N82-32356

G

GAJKOWSKI, B. J.
User's guide for the rotorcraft flight simulation
computer program C81, AGAP80 version, CDC
conversion
[AD-A115801] N82-32388

GALDA, K. H.
Mathematical model for a maintenance program for
modern jet aircraft
[ESA-TT-724] N82-32308

GAMBELL, A. W.
The WSI real-time aviation weather information
system - An alternative to standard general
aviation weather briefing procedures
A82-45834

GARDNER, W. B.
Energy efficient engine: High pressure turbine
uncooled rig technology report
[NASA-CR-165149] N82-32383

GARTRELL, L. R.
Laser Doppler velocimetry application in the
Langley 0.3-meter Transonic Cryogenic Tunnel
N82-32696
Some NTP laser velocimeter installation and
operation considerations N82-32698

GAUZE, J. E.
Foreign (turbine powered) helicopter production:
A threat to the United States production base
[AD-A116755] N82-32305

GRISLER, E. B.
A tower approach to slant visual range observation
and prediction
A82-45818

GERDES, R. H.
A ground-simulator investigation of helicopter
longitudinal flying qualities for instrument
approach
[NASA-TN-84225] N82-33398

GIBBONS, H. H.
Environmental exposure effects on composite
materials for commercial aircraft
[NASA-CR-165981] N82-32421

GILBERT, E. G.
System optimization by periodic control
[AD-A117815] N82-33402

GILBERT, H. E.
Data reduction procedures for Sea King helicopter
flight trials
[AD-A117044] N82-32359

GILLES, D. L.
Development of a low risk augmentation system for
an energy efficient transport having relaxed
static stability
[NASA-CR-159166] N82-32377

GIRAYTIS, J.
Aircraft meteorological data relay /AMDAR/
A82-45822

GOAD, W. K.
Seeding through flows in Langley's 0.3-meter
Transonic Cryogenic Tunnel
N82-32678

Flow field studies using holographic
interferometry at Langley
N82-32682

GOETTING, H. C.
Mathematical model for a maintenance program for
modern jet aircraft
[ESA-TT-724] N82-32308

GOLDRICH, R. H.
Kinematic precision of gear trains
[NASA-TN-92887] N82-32733

GOLDSMITH, I. M.
Advanced turboprop testbed systems study
[NASA-CR-167895] N82-33375

GOODERUM, P. B.
Flow field studies using holographic
interferometry at Langley
N82-32682

GOODRICK, T. F.
Development of methods for assessment of gliding
parachute applications
[AD-A117103] N82-33356

GRAND, A. F.
Assessment of burning characteristics of aircraft
interior materials
[NASA-CR-166390] N82-32899

GREEN, H.
The AIDS/F-18 diffractive HUD
[AD-A116026] N82-33382

GREISSING, J. P.
Propeller flow visualization techniques
N82-32672
Development of a laser velocimeter for a large
transonic wind tunnel
N82-32688

GRISHIN, A. H.
Investigation of the aerodynamics of axisymmetric
bodies in supersonic flow in the presence of
localized injection
A82-46692

GROSS, E. H.
The Center Weather Service Unit program /CWSU/
A82-45828
Weather support for helicopter operations in the
Gulf of Mexico
A82-45829

The Aviation Route Forecast /ARF/ program - An
interactive system for Pilot Self-Briefing
A82-45830

GUBSER, J. L.
Harpoon missile captive-carry dynamic environments
on the A-6E aircraft
A82-47072

GUYTON, R. W.
Sound transmission through ducts and aircraft
noise prediction, volume 1
[AD-A115783] N82-33164

H

HAPP, K. W.
Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408

HAINES, P.
Heavy rain/wind shear accidents
A82-45825

HANOUDA, M. H. H.
Helicopter vibration suppression using simple
pendulum absorbers on the rotor blade
[NASA-CR-3619] N82-33734

HAWKE, D.
Use of DPVLR in-flight simulator HPB 320 Hansa for
handling qualities investigations
A82-45146

HANSEN, R. S.
Toward a better understanding of helicopter
stability derivatives
[NASA-TN-84277] N82-32376

HANSON, D. C.
Aircraft alerting systems standardization study.
Phase 4: Accident implications on systems design
[AD-A117876] N82-33388

HARPER, J. C.
Analysis and environmental fate of Air Force
distillate and high density fuels
[AD-A115949] N82-32512

HARRINGTON, W. W.
Terrain following/terrain avoidance system concept
development
N82-33363

HARRISON, R. L.
An Operational evaluation of head up displays for
civil transport operations. NASA/FAA phase 3
report
[NASA-TP-1815] N82-33381

HARVEY, C. A.
Self-tuning regulator design for adaptive control
of aircraft wing/store flutter
A82-45538

HAYKIN, S.
Maximum-entropy spectral analysis of radar clutter
A82-47407

- HELMES, V. T.**
Flow field studies using holographic interferometry at Langley
N82-32682
- HEMINGWAY, J. C.**
An Operational evaluation of head up displays for civil transport operations. NASA/FAA phase 3 report
[NASA-TP-1815]
N82-33381
- HEYLIGER, G. E.**
High Order Languages /HOL/ for flight control applications
[AAS 82-020]
A82-45608
- HICKLEY, D. H.**
Noise measurement in wind tunnels, workshop summary
[NASA-TN-84219]
N82-34188
- HILLIARD, H.**
Aircraft energy conservation during airport ground operations
[AD-A116138]
N82-32352
- HINDSON, W. S.**
Analysis of several glidepath and speed control autopilot concepts for a powered lift STOL aircraft
[NASA-TN-84282]
N82-33400
- HITCHCOCK, L.**
Pitts' principles still applicable - Computer monitoring of fighter aircraft emergencies
A82-46254
- HODAK, G. W.**
Chief of Naval Air Training automated management information system (CANIS) users guide
[AD-A115852]
N82-33280
- HOPMANN, C. P.**
Passive direction finding and signal location
A82-45346
- HOPR, J.**
Exterior noise on the fuselage of light propeller driven aircraft in flight
A82-46114
- HOGUE, J. G.**
Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2]
N82-32345
- HOGUE, J. H.**
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1]
N82-32344
- HOLLER, E. H.**
Math model description for the Visual Technology Research Simulator (VTRS) conventional takeoff and landing (CTOL) weapon delivery visual system
[AD-A117141]
N82-33407
- HOLST, T. L.**
Recent applications of the transonic wing analysis computer code, TWIN3
[NASA-TN-84283]
N82-33346
- HOLTZ, D. R.**
Vapor condensation control of JP-4 emissions from underground storage tanks at March Air Force Base, California
[AD-A117875]
N82-33554
- HONAKER, W. C.**
Velocity and flow angle measurements in the Langley 0.3-meter transonic cryogenic tunnel using a laser transit anemometer
N82-32697
- Some NTF laser velocimeter installation and operation considerations
N82-32698
- HONRATH, J. P.**
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1]
N82-32344
- Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2]
N82-32345
- HOOVEN, W. T., III**
Selected furnace brazed components for the aerospace industry
A82-46529
- HOROWITZ, S. H.**
Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664]
N82-33369
- HORROX, P. H. T.**
Avionic system development for the Tornado F MK2
[REPT-96]
N82-32361
- HOVER, G. L.**
Preliminary assessment of US Coast Guard Short Range Recovery (SRR) Forward Looking Infrared (FLIR) system small target detection performance
[AD-A117916]
N82-34230
- HOWARD, W. G.**
Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877]
N82-33379
- HOWISON, W. W.**
Aircraft alerting systems standardization study. Phase 4: Accident implications on systems design
[AD-A117876]
N82-33388
- HUANG, H.-K.**
Two-dimensional apparent masses for cross-flow sections of wing-store configurations
A82-46801
- HUFFMAN, W.**
Automated Low-cost Weather Observation System (ALWOS)
[AD-A117447]
N82-33954
- HUGGETT, H. P.**
Low level wind shear detection system for airport landing approach areas using the Bertin Doppler acoustic sounder /Sodar/
A82-45816
- HULL, R.**
Development of a rotorcraft. Propulsion dynamics interface analysis, volume 1
[NASA-CR-166380]
N82-32368
- Development of a rotorcraft. Propulsion dynamics interface analysis, volume 2
[NASA-CR-166381]
N82-32369
- HUNTER, W. W., JR.**
Some NTF laser velocimeter installation and operation considerations
N82-32698
- HUTTON, P. G.**
Shadowgraph techniques in transonic tests with powered nacelles
N82-32674
- I**
- IANSON, A. I.**
Variational equation of an eccentrically reinforced panel with allowance for nonuniform heating
A82-46617
- IMBENBO, S.**
Automated Low-cost Weather Observation System (ALWOS)
[AD-A117447]
N82-33954
- IRONS, R. C.**
Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676]
N82-32389
- ITOH, G.**
A review of the history of nondestructive testing in Japan
A82-48257
- J**
- JABER, H.**
Analysis and environmental fate of Air Force distillate and high density fuels
[AD-A115949]
N82-32512
- JARISCH, W.**
Determination of material properties by limited scan X-ray tomography
[AD-A116670]
N82-32422
- JAYNES, D. H.**
Static investigation of the circulation control wing/upper surface blowing concept applied to the quiet short haul research aircraft
[NASA-TN-84232]
N82-32343
- JENNESS, C. H.**
Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans
[NASA-CR-167928-VOL-1]
N82-32370
- JENNINGS, A. H.**
Lift system and fan performance of air cushion supported vehicles
[AD-A117363]
N82-33570
- JOHNSON, T. L.**
Self-tuning regulator design for adaptive control of aircraft wing/store flutter
A82-45538

- JOHNSTON, R. P.
Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366
- JONES, S.
Reliability, Availability, Maintainability Data
Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378
- JONES, S. B.
Flow visualization in the Langley 0.3-meter
Transonic Cryogenic Tunnel and preliminary plans
for the National Transonic Facility N82-32677
- JUMPER, S. J.
Computer prediction of three-dimensional potential
flow fields in which aircraft propellers operate
[NASA-CR-169317] N82-32312

K

- KEECH, T.
Impact of an omnidirectional traffic alert and
collision avoidance system on the air traffic
control radar beacon system and the discrete
address beacon system
[AD-A116170] N82-32336
- KRIMM, H.
Scenarios of economic development within the
European community up to the year 2000
[ESA-TT-730] N82-33286
- KRITZER, L. D.
Impact of advanced propeller technology on
aircraft/mission characteristics of several
general aviation aircraft
[NASA-CR-167984] N82-33347
- KESLER, S. B.
Maximum-entropy spectral analysis of radar clutter
A82-47407
- KHALITOV, I. KH.
Choice of weight coefficients in the problem of
the optimal damping of the elastic oscillations
of a wing A82-46608
- KHODAK, M. A.
Prediction of fatigue crack propagation in plane
specimens and thin-walled structural elements of
aircraft wing skin under programmed loading
A82-47229
- KILGORE, R. A.
Cryogenic wind tunnels: A selected, annotated
bibliography
[NASA-TN-84474] N82-33405
- KIN, J. G.
Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453] N82-32573
- KNAPP, M. H.
Active clearance control system for a turbomachine
[NASA-CASE-LEW-12938-1] N82-32366
- KNORR, G.
An analytical study of landing flare
[ESA-TT-656] N82-32360
- KO, T.
Design of helicopter rotor blades for optimum
dynamic characteristics
[NASA-CR-169352] N82-33374
- KOERT, D. M.
Aerostructure nondestructive evaluation by thermal
field detection, phase 1: Fundamental
information and basic technique development
[AD-A115724] N82-32425
- KOLB, A. W.
Development of a Structural Integrity Recording
System (SIRS) for US Army AH-1S helicopters
[AD-A116027] N82-32364
- KOOPMANN, G. H.
Noise reduction in centrifugal fans by the use of
 $\lambda/4$ resonators
[ESA-TT-723] N82-33173
- KORN, A. E.
Design of helicopter rotor blades for optimum
dynamic characteristics
[NASA-CR-169352] N82-33374
- KOVALENKOV, M. M.
Heat transfer from nozzles under the conditions of
flow laminarization A82-46831
- KRAUSE, M.
Attribute requirements for a simulated flight
scenario microcomputer test
[AD-A115676] N82-32389

- KRAUSPE, P.
Wind determination and wind shear detection from
flight test and airline flight data A82-45815
- KRAVCHUK, L. V.
Modeling of thermal effects when investigating the
thermal fatigue life of the blades of a
gas-turbine engine A82-46832
- KRETH, J.
Mathematical model for a maintenance program for
modern jet aircraft
[ESA-TT-724] N82-32308
- KROSEL, S. M.
Automated procedure for developing hybrid computer
simulations of turbofan engines. Part 1:
General description
[NASA-TP-1851] N82-33020
- KUHN, R. E.
High pressure bleed for STOL and STO-VL
performance: A conceptual examination
[AD-A115762] N82-32357
- KURSHIN, L. M.
Variational equation of an eccentrically
reinforced panel with allowance for nonuniform
heating A82-46617

L

- LAN, P.
Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390
- LAMBETH, B. S.
Reflections on an F-43 in flight emergency
[AD-A116873] N82-33358
- LANGE, H.-H.
Use of DFVLR in-flight simulator HFB 320 Hansa for
handling qualities investigations A82-45146
- LASHKOV, I. A.
An experimental study of flow rate and thrust
characteristics of a four-nozzle ejector with
flow twist A82-46140
- LAUBER, J. K.
An Operational evaluation of head up displays for
civil transport operations. NASA/PAA phase 3
report
[NASA-TP-1815] N82-33381
- LAUFER, T.
The Aviation Route Forecast /ARF/ program - An
interactive system for Pilot Self-Briefing
A82-45830
- LAVAL, P.
Computation of three dimensional unsteady
nonuniform flow in the blade-free annular
channel of a turbomachine
[ONERA-NT-1982-2] N82-32372
- LEACH, K.
Energy efficient engine: Turbine transition duct
model technology report
[NASA-CR-167996] N82-33394
- LEBACQZ, J. V.
A ground-simulator investigation of helicopter
longitudinal flying qualities for instrument
approach
[NASA-TN-84225] N82-33398
- LEE, G.
Holographic interferometry and tomography at Ames
Research Center N82-32681
- LEE, J. T.
Turbulence and wind shear experiments related to
aircraft operation in the terminal area A82-45817
- LEFFERTS, R. E.
Altitude estimation using asynchronous alpha-beta
tracking filters A82-46387
- Improving conflict alert performance using moving
target detector data
[AD-A117691] N82-33370
- Memory and computational requirements for tracking
in the advanced computer system
[AD-A117666] N82-33619

- LEISTER, H. J.
TRACALS evaluation report. Special report: A procedure for RTT position improvement using linear regression analysis of glide slope structure
[AD-A115926] N82-33365
- LEMOINE, A.
Enhancements and algorithms for avionic information processing system design methodology
[AD-A117948] N82-33385
- LEWANDOWSKI, G. A.
Predictive model for jet engine test cell opacity
[AD-A117585] N82-33397
- LI, Z.
Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
N82-45188
- LITTLE, B. H.
Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans
[NASA-CR-167928-VOL-1] N82-32370
- LITVIN, P. L.
Kinematic precision of gear trains
[NASA-TN-82887] N82-32733
- LIU, C. H.
Supersonic jet noise generated by large scale instabilities
[NASA-TP-2072] N82-34189
- LORTIONOV, A. P.
Measuring flexural loads by means of strain transducers
N82-46619
- LOONIS, J. P.
The performance of warning systems in avoiding Controlled-Flight-Into-Terrain /CFIT/ accidents
N82-46255
- LURRS, J. K.
Heavy rain/wind shear accidents
N82-45825
- LUKIANOV, P. P.
Parameterization in the design of surfaces by means of Coons' method
N82-46620
- LUTKE, F. H.
Rolling flow wind tunnel tests of F-18 aircraft
[NASA-CR-169344] N82-33338
Curved flow wind tunnel test of F-18 aircraft
[NASA-CR-169345] N82-33339
- LYNCH, R. H.
A modular automated approach to airfield weather systems
N82-45813
- M**
- MACARTHUR, C. D.
Dayton aircraft cabin fire model, version 3. Volume 1: Physical description
[AD-A117905] N82-33361
- MACINTYRE, W. G.
Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928] N82-33552
- MADDALON, D. V.
NASA research on viscous drag reduction
[NASA-TN-84518] N82-33344
- MADDOX, R. A.
Mesoscale convective complexes and general aviation
N82-45832
- MAESTRELLO, L.
Simulation of the fluctuating field of a forced jet
[NASA-TN-84506] N82-34191
- MAHAPATRA, P. R.
Considerations for optimum siting of NEBRAD to detect convective phenomena hazardous to terminal air navigation, part 1
[DOT/FAA/RD-82/56] N82-32329
- MAKAREVSKII, A. I.
Fundamentals of strength and aeroelasticity in flight vehicles
N82-45762
- MAIANOSKI, S. B.
Subsynchronous vibrations of rotor systems
N82-32528
- MARCHIONDA, K. H.
Speech Command Auditory Display System (SCADS)
[AD-A117486] N82-33387
- MATASOV, A. I.
Observability of the parameters of an inertial navigation system for a 360-deg coordinated turn
N82-47093
- MAYNARD, J. A.
Airborne Flight Test System (APTS)
[AD-A115100] N82-32354
- MAZOUR, T. J.
Preliminary assessment of US Coast Guard Short Range Recovery (SR8) Forward Looking Infrared (FLIR) system small target detection performance
[AD-A117916] N82-34230
- MCCALISTER, K. W.
An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245] N82-32314
- MCASSEY, E. V.
Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724] N82-32425
- MCCROSKEY, W. J.
An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TN-84245] N82-32314
- MCCENTIRE, P.
Enhancements and algorithms for avionic information processing system design methodology
[AD-A117948] N82-33385
- MCFARLAND, R. H.
Efficient transfer of weather information to the pilot in flight
[NASA-CR-165889] N82-32363
- MCLAUGHLIN, D. K.
Supersonic jet noise generated by large scale instabilities
[NASA-TP-2072] N82-34189
- MCLAUGHLIN, P. V.
Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724] N82-32425
- MCLEAN, D.
Active control technology in aircraft
N82-32303
- MEDAN, R. T.
User's manual for interfacing a leading edge, vortex rollup program with two linear panel methods
[NASA-TN-78584] N82-33340
- MELLOR, A. H.
Performance of SRC II fuels in gas-turbine combustors. Alternative-fuels-utilization program
[DB82-010471] N82-32518
- MENSHIKOV, V. I.
A study of wing vorticity patterns
N82-46621
- MEYER, R. T.
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1] N82-32344
Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2] N82-32345
- MEYERS, J. E.
Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914] N82-33392
- MEZENTSEV, L. G.
An algorithm, invariant relative to the initial data, for implementing the polynomial contouring method
N82-46628
- MINODA, H.
Development of high loading, high efficiency axial flow turbine
N82-47069
- MITCHELL, T. R.
The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing
N82-45830
- MOLUSIS, J. A.
Rotorcraft blade mode damping identification from random responses using a recursive maximum likelihood algorithm
[NASA-CR-3600] N82-33373

- MOORE, J. W.
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1] N82-32344
Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2] N82-32345
- MOORE, R. D.
Rotor tip clearance effects on overall and
blade-element performance of axial-flow
transonic fan stage
[NASA-TP-2049] N82-33389
- MORAN, D. D.
Lift system and fan performance of air cushion
supported vehicles
[AD-A117363] N82-33570
- MOROZ, E. Y.
Development and test of a tactical visibility sensor
A82-45820
- MOROZOV, V. M.
Observability of the parameters of an inertial
navigation system for a 360-deg coordinated turn
A82-47093

N

- NAGLE-ESHEMAN, J.
The Shock and Vibration Digest, volume 14, no. 7
[AD-A117323] N82-32301
The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525
- NANKBY, R. W.
A random vibration test for the evaluation of
stiff sensitive component parts
A82-47073
- NASH, L.
Preliminary assessment of US Coast Guard Short
Range Recovery (SRR) Forward Looking Infrared
(FLIR) system small target detection performance
[AD-A117916] N82-34230
- NEISE, W.
Acoustic similarity laws for centrifugal fans
[ESA-TT-712] N82-33172
Noise reduction in centrifugal fans by the use of
 $\lambda/4$ resonators
[ESA-TT-723] N82-33173
- NEUMANN, H. E.
LV measurements with an advanced turboprop
N82-32690
- NICHOLS, J. H., JR.
Static investigation of the circulation control
wing/upper surface blowing concept applied to
the quiet short haul research aircraft
[NASA-TN-84232] N82-32343
- NICHOLS, S. E.
Maintenance support resource forecasting models.
Volume 2: Equivalence testing of reliability
and maintenance model and expected values model
[AD-A117149] N82-32307
- NIRMAN, J. E.
Climatic laboratory evaluation YCH-47D helicopter
[AD-A115861] N82-32355
- NIKITYN, A. M.
The technology of the assembly of engines for
flight vehicles
A82-45765
- NISHT, M. I.
The effect of a weak shock wave on a wing of
complex planform at supersonic velocities
A82-46132
- NOONAN, K. W.
Family of airfoil shapes for rotating blades
[NASA-CASE-LAR-12843-1] N82-33372
- NORUM, T. D.
Measurements of mean static pressure and far field
acoustics of shock containing supersonic jets
[NASA-TN-84521] N82-33150
- HOUSE, E.
Development of high loading, high efficiency axial
flow turbine
A82-47069

O

- OVCHAROV, M. M.
A study of wing vorticity patterns
A82-46621
- OVERDORP, R. L.
Terrain following/terrain avoidance system concept
development
N82-33363

P

- PADOVAN, J.
Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390
- PANDE, S. S.
Analysis of tapered-land hybrid aerostatic journal
bearings
A82-47944
- PANIN, V. F.
Honeycomb cored structures
A82-45775
- PATEL, S. P.
Long duct nacelle aerodynamic development for
DC-10 derivatives
[NASA-CR-159271] N82-32315
Investigation of the interference effects of mixed
flow long duct nacelles on a DC-10 wing
[NASA-CR-159202] N82-32319
- PATRICK, G.
Impact of an omnidirectional traffic alert and
collision avoidance system on the air traffic
control radar beacon system and the discrete
address beacon system
[AD-A116170] N82-32336
- PAULOVICH, E. J.
Propeller flow visualization techniques
N82-32672
- PAVELKO, A. J.
Labyrinth seal effects on rotor bearing system
stability
[AD-A116774] N82-32742
- PERLE, W. D.
USAF Summer Faculty Research Program. Volume 1:
1981 research reports
[AD-A113708] N82-34340
USAF Summer Faculty Research Program. Volume 2:
1981 research reports
[AD-A113709] N82-34341
- PEEPLES, T. O.
Chief of Naval Air Training automated management
information system (CANIS) users guide
[AD-A115852] N82-33280
- PENDERGRAFT, O. C., JR.
Effect of nozzle and vertical-tail variables on
the performance of a 3-surface F-15 model at
transonic Mach numbers
[NASA-TP-2043] N82-32320
- PETERS, D. A.
Design of helicopter rotor blades for optimum
dynamic characteristics
[NASA-CR-169352] N82-33374
- PETERSEN, R. H.
NASA research on viscous drag reduction
[NASA-TN-84518] N82-33344
- PETERSON, R. A.
Universal turret system model determination and
controller performance testing
[AD-A117687] N82-33380
- PHILLIPS, W. H.
Some design considerations for solar-powered
aircraft
[NASA-TP-1675] N82-32350
- PIERCE, G. A.
Helicopter vibration suppression using simple
pendulum absorbers on the rotor blade
[NASA-CR-3619] N82-33734
- PLATT, C. E.
Structural tailoring of engine blades (STAEBL)
[NASA-CR-167949] N82-33391
- POLOVKOV, A. F.
The effect of a weak shock wave on a wing of
complex planform at supersonic velocities
A82-46132
- POPITALOV, S. A.
The effect of a weak shock wave on a wing of
complex planform at supersonic velocities
A82-46132

POBITZKY, S. B.
Preliminary analysis of the benefits and costs to implement the National Airspace System Plan
[AD-A117664] N82-33369

PORTER, R. F.
The performance of warning systems in avoiding Controlled-Flight-Into-Terrain /CFIT/ accidents
N82-46255

POWELL, C. W.
Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans
[NASA-CR-167928-VOL-1] N82-32370

PRATT, T. K.
Structural tailoring of engine blades (STAEEL)
[NASA-CR-167949] N82-33391

PRINE, R.
Mathematical model for a maintenance program for modern jet aircraft
[ESA-TT-724] N82-32308

PUCCI, S. L.
An experimental study of dynamic stall on advanced airfoil sections. Volume 1: Summary of the experiment
[NASA-TM-84245] N82-32314

PURVIS, J. W.
A simulation language approach to structural interaction problems
N82-33758

Q

QUEFFEULOU, P.
A comparison of Seasat-derived wave height with surface data
N82-47496

R

RACHOVITSKY, E.
Terrain following/terrain avoidance system concept development
N82-33363

RATUIK, I. U. A.
Airfield construction - A reference book
N82-48264

RAU, T. H.
USAF Bioenvironmental Noise Data Handbook, volume 154
[AD-A116146] N82-33152

USAF Bioenvironmental Noise Data Handbook. Volume 149: C-9A in-flight crew/passenger noise
[AD-A116145] N82-33153

USAF bioenvironmental noise data handbook. Volume 161: A/M32A-86 generator set, diesel engine driven
[AD-A116147] N82-33154

USAF bioenvironmental noise data handbook. Volume 162: MD-4MO generator set
[AD-A116148] N82-33155

USAF bioenvironmental noise data handbook. Volume 163: GPC-28 compressor
[AD-A116149] N82-33156

UDAF bioenvironmental noise data handbook. Volume 164: MD-1 heater, duct type, portable
[AD-A116150] N82-33157

USAF Bioenvironmental Noise Data Handbook. Volume 165: MC-1 heater, duct type, portable
[AD-A116151] N82-33158

USAF Bioenvironmental Noise Data Handbook. Volume 167: MA-3M air conditioner
[AD-A116152] N82-33159

USAF bioenvironmental noise data handbook. Volume 168: MB-3 tester, pressurized cabin leakage, aircraft
[AD-A116153] N82-33163

USAF bioenvironmental noise data handbook. Volume 158: F-106A aircraft, near and far-field noise
[AD-A116930] N82-33168

REDDY, K. C.
Numerical stability analysis of a compressor model
[AD-A116878] N82-33396

REED, L. W.
Voice Interactive Systems Technology Avionics (VISTA) Program
[AD-A117288] N82-33383

REED, W. H., III
Decoupler pylon: wing/store flutter suppressor
[NASA-CASE-LAR-12468-1] N82-32373

REIP, H. E.
An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551

REISING, J.
Fitts' principles still applicable - Computer monitoring of fighter aircraft emergencies
N82-46254

REYNOLDS, P. W.
Numerical applications of the physical optics approach for the calculation of radar cross sections of convex perfect scatterers
[BAE-MSN-261] N82-32600

REZY, B. J.
Exhaust emissions reduction for intermittent combustion aircraft engines
[NASA-CR-167914] N82-33392

RHODES, D. B.
Flow visualization in the Langley 0.3-meter Transonic Cryogenic Tunnel and preliminary plans for the National Transonic Facility
N82-32677

RIGGS, K. E.
Diffuser/ejector system for a very high vacuum environment
[NASA-CASE-NFS-15791-1] N82-33712

RISER, H.
Reliability, Availability, Maintainability Data Tracking Plan improved GUARDRAIL 5
[AD-A117933] N82-33378

RIZZETTA, D. P.
Nonlinear transonic flutter analysis
[AIAA PAPER 81-0608] N82-46847

ROBERTS, L.
Recent progress in VSTOL technology
[NASA-TM-84238] N82-33334

ROBINSON, C.
Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385] N82-32374

ROBINSON, L. A.
Executive summary of systems analysis to develop future civil aircraft noise reduction alternatives
[AD-A116467] N82-33162

ROSE, J.
Cost and benefits design optimization model for fault tolerant flight control systems
[NASA-CR-159281] N82-32379

ROSSOW, H. P.
Design of helicopter rotor blades for optimum dynamic characteristics
[NASA-CR-169352] N82-33374

ROWE, B. H.
Why G2 made a moteur d'aviation
N82-45499

RUAN, T.
Study on pressure distribution on rotor blades with three-dimensional nonsteady theory of compressible fluid
N82-45188

RUSSELL, R. E.
Aircraft noise reduction
N82-45846

S

SADYKOV, I. KH.
Optimization of dispatching discipline in queueing systems with limited queues
N82-46607

SATOO, T.
Development of high loading, high efficiency axial flow turbine
N82-47069

SAVISAAR, A.
Development of avionics installation interface standards
[AD-A116853] N82-33384

SCHAFFAR, H.
Study of the source function by the causality methods defined by Ribner and Siddon
[PB82-205170] N82-34196

- SCHAUER, J. J.
Sound transmission through ducts and aircraft noise prediction, volume 1
[AD-A115783] N82-33164
- SCHERLLE, E.
Calculation of the stability and post-buckling behavior of thin shell underframes using the finite element method
A82-45219
- SCHINTT, A.
Scenarios of economic development within the European community up to the year 2000
[ESA-TT-730] N82-33286
- SCHNEIDER, A.
An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551
- SCHUBERT, E.
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978
[ESA-TT-739] N82-32338
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 3, 1979
[ESA-TT-740] N82-32339
- SCHULTZ, F. J.
Testing of tritium-powered runway distance and taxiway markers
[AD-A114558] N82-33408
- SCHWEDECK, J. P.
An exploratory research and development program leading to specifications for aviation turbine fuel from whole crude shale oil, part 5
[AD-A117438] N82-33551
- SCOTT, B. C.
An Operational evaluation of head up displays for civil transport operations. NASA/FAA phase 3 report
[NASA-TP-1815] N82-33381
- SEASHOLTZ, R. G.
Status of laser anemometry in turbomachinery research at the Lewis Research Center
N82-32686
- SEINER, J. M.
Measurements of mean static pressure and far field acoustics of shock containing supersonic jets
[NASA-TN-84521] N82-33150
Supersonic jet noise generated by large scale instabilities
[NASA-TP-2072] N82-34189
- SELLERS, W. L.
Applications of a laser velocimeter in the Langley 4- by 7-meter tunnel
N82-32693
- SENG, G. T.
Characterization of an Experimental Referee Broadened Specification (ERBS) aviation turbine fuel and ERBS fuel blends
[NASA-TN-82883] N82-32504
- SERAFINI, J. S.
LV measurements with an advanced turboprop
N82-32690
- SEWALL, W. G.
Application of a transonic similarity rule to correct the effects of sidewall boundary layers in two-dimensional transonic wind tunnels
[NASA-TN-84847] N82-32384
- SHYFRIED, A.
Analysis of two air traffic samples in the Frankfurt/Main airport terminal area, August 4, 1978
[ESA-TT-739] N82-32338
- SHAKOTKO, A. G.
Observability of the parameters of an inertial navigation system for a 360-deg coordinated turn
A82-47093
- SHANNON, R. H.
Attribute requirements for a simulated flight scenario microcomputer test
[AD-A115676] N82-32389
- SHAW, J.
Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385] N82-32374
- SHERIDAN, P. F.
Math modeling for helicopter simulation of low speed, low altitude and steeply descending flight
[NASA-CR-166385] N82-32374
- SHOAP, L.
Advanced turboprop testbed systems study. Volume 1: Testbed program objectives and priorities, drive system and aircraft design studies, evaluation and recommendations and wind tunnel test plans
[NASA-CR-167928-VOL-1] N82-32370
- SHOLLEBERGER, C. A.
Application of an optimized winglet configuration to an advanced commercial transport
[NASA-CR-159156] N82-32348
- SHOVLIN, M. D.
Static investigation of the circulation control wing/upper surface blowing concept applied to the quiet short haul research aircraft
[NASA-TN-84232] N82-32343
- SHRIER, S.
Alternative employment concepts for Remotely Piloted Vehicle (RPV) FLIR/TV mission payload
[AD-A117877] N82-33379
- SHUMILKINA, E. A.
An experimental study of flow rate and thrust characteristics of a four-nozzle ejector with flow twist
A82-46140
- SIRAZETDINOV, T. K.
Choice of weight coefficients in the problem of the optimal damping of the elastic oscillations of a wing
A82-46608
- SISAR, M.
Design of analytical failure detection using secondary observers
[NASA-TN-84284] N82-32362
- SIVANERI, W.
Aeroelastic stability of rotor blades using finite element analysis
[NASA-CR-166389] N82-32342
- SIZLO, T. R.
Development of a low risk augmentation system for an energy efficient transport having relaxed static stability
[NASA-CR-159166] N82-32377
- SHIOT, G.
Aircraft meteorological data relay /ANDAR/
A82-45822
- SMITH, C. L.
Hydrocarbon fuel chemistry: Sediment water interaction
[AD-A117928] N82-33552
- SMITH, C. M. D.
Development of avionics installation interface standards
[AD-A116853] N82-33384
- SMITH, J. H.
Analysis and environmental fate of Air Force distillate and high density fuels
[AD-A115949] N82-32512
- SNOW, W. L.
Seeing through flows in Langley's 0.3-meter Transonic Cryogenic Tunnel
N82-32678
Flow field studies using holographic interferometry at Langley
N82-32682
- SONASUNDARAM, S.
Analysis of tapered-land hybrid aerostatic journal bearings
A82-47944
- SPARKMAN, J.
Aircraft meteorological data relay /ANDAR/
A82-45822
- SPIZZER, J. M.
Aerostructure nondestructive evaluation by thermal field detection, phase 1: Fundamental information and basic technique development
[AD-A115724] N82-32425
- STECKBECK, F. J.
The Aviation Route Forecast /ARF/ program - An interactive system for Pilot Self-Briefing
A82-45830
- STEPKO, G. L.
Propeller flow visualization techniques
N82-32672

- STEIN, G.
Self-tuning regulator design for adaptive control
of aircraft wing/store flutter
A82-45538
- STEPHENS, R. E.
Multibody aircraft study, volume 1
[NASA-CR-165829-VOL-1] N82-32344
Multibody aircraft study, volume 2
[NASA-CR-165829-VOL-2] N82-32345
- STRAHL, G. A.
Universal turret system model determination and
controller performance testing
[AD-A117687] N82-33380
- STRECKENBACH, J. H.
Aircraft noise reduction
A82-45846
- STUCKAS, K. J.
Exhaust emissions reduction for intermittent
combustion aircraft engines
[NASA-CR-167914] N82-33392
- SU, C. W.
Hydrocarbon fuel chemistry: Sediment water
interaction
[AD-A117928] N82-33552
- SUBRAMANIAN, M. R.
Recent applications of the transonic wing analysis
computer code, TWING
[NASA-TN-84283] N82-33346
- SUDAKOV, G. G.
An asymptotic theory of separated flow past
low-aspect-ratio wings
A82-46135
- SULC, J.
Exterior noise on the fuselage of light propeller
driven aircraft in flight
A82-46114
- SULLIVAN, M.
Development of avionics installation interface
standards
[AD-A116853] N82-33384
- SUTHERLAND, L. C.
Evaluation of noise control technology and
alternative noise certification procedures for
propeller-driven small airplanes
[AD-A116495] N82-33151
Effects of filter response on analysis of aircraft
noise data
[AD-A116458] N82-33167
- SWOLINSKY, M.
Wind determination and wind shear detection from
flight test and airline flight data
A82-45815
- STUCH, J. R.
Automated procedure for developing hybrid computer
simulations of turbofan engines. Part 1:
General description
[NASA-TP-1851] N82-33020
- T**
- TAGHAVI, H.
The effect of heat transfer on three-dimensional
spatial stability and transition of flat plate
boundary layer at Mach 3
A82-45877
- TAKAHARA, K.
Development of high loading, high efficiency axial
flow turbine
A82-47069
- TAKESHIMA, K.
Development of high loading, high efficiency axial
flow turbine
A82-47069
- TANABUCHI, H. Z.
The Shock and Vibration Digest, volume 14, no. 7
[AD-A117323] N82-32301
The Shock and Vibration Digest, volume 14, no. 3
[AD-A112586] N82-32525
- TANEJA, D. M.
Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651
- TANK, W. G.
The airplane manufacturer and meteorology
A82-45821
- TAYLOR, A. B.
Selected winglet and mixed flow long duct nacelle
development for DC-10 derivative aircraft
[NASA-CR-3296] N82-32347
- THOMAS, S. D.
Recent applications of the transonic wing analysis
computer code, TWING
[NASA-TN-84283] N82-33346
- THOMPSON, J.
Aircraft energy conservation during airport ground
operations
[AD-A116138] N82-32352
- THOMPSON, R. L.
Nonlinear constitutive theory for turbine engine
structural analysis
N82-33744
- THURLIN, R.
Energy efficient engine: Turbine transition duct
model technology report
[NASA-CR-167996] N82-33394
- TIBBETTS, J. G.
A computer program for the prediction of near
field noise of aircraft in cruising flight:
User's guide
[NASA-CR-159274] N82-33148
- TOMPKINS, J. A.
Testing of tritium-powered runway distance and
taxiway markers
[AD-A114558] N82-33408
- TONG, E. H.
Performance of SRC II fuels in gas-turbine
combustors. Alternative-fuels-utilization program
[DB82-010471] N82-32518
- TONOHURA, Y.
Development of high loading, high efficiency axial
flow turbine
A82-47069
- TREMBLEY, W.
FAA air traffic activity, FY 1981
[PB82-200361] N82-33371
- TSAO, C. P.
A color video display technique for flow field
surveys
N82-32669
- TSUI, Y. Y.
Numerical stability analysis of a compressor model
[AD-A116878] N82-33396
- TUCKER, J. R.
Exhaust emissions reduction for intermittent
combustion aircraft engines
[NASA-CR-167914] N82-33392
- TUNG, C.
Finite difference modeling of rotor flows
including wake effects
[NASA-TN-84280] N82-33345
- TURKEL, E.
Simulation of the fluctuating field of a forced jet
[NASA-TN-84506] N82-34191
- TUTTLE, M. H.
Cryogenic wind tunnels: A selected, annotated
bibliography
[NASA-TN-84474] N82-33405
- V**
- VALYS, A. J.
Assessment of burning characteristics of aircraft
interior materials
[NASA-CR-166390] N82-32899
- VAN NIEKERK, C. G.
Planning for noise impact around airports
A82-45847
- VERHEULEN, A. J.
Finite element approach to the calculation of
unsteady aerodynamic influence coefficients in
dynamic aeroelastic analysis
A82-45849
- VOELCKERS, U.
Analysis of two air traffic samples in the
Frankfurt/Main airport terminal area, August 4,
1978
[ESA-TT-739] N82-32338
Analysis of two air traffic samples in the
Frankfurt/Main airport terminal area, August 3,
1979
[ESA-TT-740] N82-32339
- VOERSHANN, P.
Wind determination and wind shear detection from
flight test and airline flight data
A82-45815
- VOLKOV, L. I.
Control of the operations of a 'flight complex'
A82-45213

- VON ALLEN, M.
Numerical calculation of the flow in compressor
and turbine cascades
A82-45222
- VOORHEES, J. W.
Speech Command Auditory Display System (SCADS)
[AD-A117486] N82-33387

W

- WALKER, E. D.
Propeller flow visualization techniques
N82-32672
- WALTERS, M. M.
Motor technology for electric Remotely Piloted
Vehicle (RPV)
[AD-A117732] N82-33651
- WANG, M.
Geodesic paths of an ellipsoid-mounted antenna
[AD-A116453] N82-32573
- WANG, S.
A simplified method for predicting rotor blade
airloads
A82-45187
- WARD, G. A.
The development of terrain following displays for
the Tornado aircraft
[REPT-200] N82-32337
- WARNOCK, W.
Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370
- WARWICK, G.
Aquila - Robot eye in the sky
A82-48025
- WATSON, W. R.
Circumferentially segmented duct lines optimized
for axisymmetric and standing wave sources
[NASA-TP-2075] N82-34190
- WAZZAN, A. R.
The effect of heat transfer on three-dimensional
spatial stability and transition of flat plate
boundary layer at Mach 3
A82-45877
- WEISS, J.
Composite repair system with long term latency
[AD-A116472] N82-32424
- WHITE, P. G.
Commercial aircraft airframe fuel systems survey
and analysis
[DOT/FAA/CT-82/80] N82-32351
- WEYHAN, J. C.
A modular automated approach to airfield weather
systems
A82-45813
- WHIPPLE, D. L.
Development of a laser velocimeter for a large
transonic wind tunnel
N82-32688
- WHITE, P.
Math modeling for helicopter simulation of low
speed, low altitude and steeply descending flight
[NASA-CR-166385] N82-32374
- WHITTLE, S.
Numerical applications of the physical optics
approach for the calculation of radar cross
sections of convex perfect scatterers
[BAE-MSN-261] N82-32600
- WIGDOROWITZ, B.
Energy methods used in air combat performance
comparisons
A82-45850
- WILHELM, K.
An analytical study of landing flare
[ESA-TT-656] N82-32360
- WILLIAMS, J.
Noise measurement in wind tunnels, workshop summary
[NASA-TN-84219] N82-34188
- WILLIAMS, M. S.
Results from tests of three prototype general
aviation seats
[NASA-TN-84533] N82-33733

- WILSON, J. M.
Advanced turboprop testbed systems study. Volume
1: Testbed program objectives and priorities,
drive system and aircraft design studies,
evaluation and recommendations and wind tunnel
test plans
[NASA-CR-167928-VOL-1] N82-32370
- WINKELMANN, A. E.
A color video display technique for flow field
surveys
N82-32669
- WOJCIECHOWSKI, C. J.
Diffuser/ejector system for a very high vacuum
environment
[NASA-CASE-NPS-15791-1] N82-33712
- WRAY, G. L.
An investigation of ring laser gyroscope random
walk experiments
A82-47157
- WRIGHT, E. R.
Replacement of aboard naval aircraft
[AD-A115782] N82-32356
- WYNN, E. C.
Measured and calculated effects of angle of attack
on the transonic flutter of a supercritical wing
[NASA-TN-83276] N82-33736

X

- XU, Z.
A simplified method for predicting rotor blade
airloads
A82-45187

Y

- YANG, S.
Application of Kalman filtering technique to
aerodynamic derivatives for a helicopter
A82-45189
- YATES, E. C., JR.
Measured and calculated effects of angle of attack
on the transonic flutter of a supercritical wing
[NASA-TN-83276] N82-33736
- YOUNG, G. D., JR.
Terrain following/terrain avoidance system concept
development
N82-33363

Z

- ZAGARESCU, P.
Romanian professor Elie Carafoli - 55 years
devotion on modern aeronautics and astronautics
[IAP PAPER 82-280] A82-47010
- ZAKHAROV, S. B.
An asymptotic theory of separated flow past
low-aspect-ratio wings
A82-46135
- ZANELLI, R.
Low level wind shear detection system for airport
landing approach areas using the Bertin Doppler
acoustic sounder /Sodar/
A82-45816
- ZARA, J. A.
Harpoon missile captive-carry dynamic environments
on the A-6E aircraft
A82-47072
- ZARETSKY, E. V.
Kinematic precision of gear trains
[NASA-TN-82887] N82-32733
- ZELD, I.
Engine dynamic analysis with general nonlinear
finite element codes. Part 2: Bearing element
implementation overall numerical characteristics
and benchmarking
[NASA-CR-167944] N82-33390
- ZELLER, P.
The determination of the duration of an exposure
to aircraft noise
A82-45221
- ZHANG, P.
An analogy method for crack initiation life
prediction
A82-45192
- ZITTLE, C. M.
Phoenix airport solar photovoltaic concentrator
project
A82-44940

PERSONAL AUTHOR INDEX

ZERNIC, D. S.

ZERNIC, D. S.

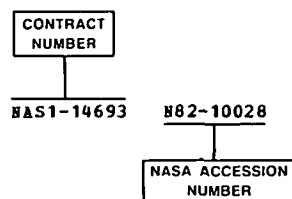
Considerations for optimum siting of FEXRAD to
detect convective phenomena hazardous to
terminal air navigation, part 1
{DOT/FAA/ED-82/56} #82-32329

CONTRACT NUMBER INDEX

AERONAUTICAL ENGINEERING/A Continuing Bibliography (Suppl. 156)

JANUARY 1983

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Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the IAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the IAA or STAR section.

AF PROJ. 649E
N82-32336
AF PROJ. 1900
N82-32512
N82-33397
N82-33552
N82-33554
AF PROJ. 1987
N82-33401
AF PROJ. 2304
N82-33402
AF PROJ. 2305
N82-34340
N82-34341
AF PROJ. 2418
N82-32422
AF PROJ. 2480
N82-33551
AF PROJ. 3066
N82-33164
AF PROJ. 3145
N82-33651
AF PROJ. 7231
N82-33152
N82-33153
N82-33158
N82-33159
N82-33163
N82-33168
N82-33359
AF-AFOSR-2881-76
N82-34191
AF-AFOSR-3158-77
N82-33402
DA PROJ. 1L1-62209-AH-76
N82-32364
DA PROJ. 1L2-62202-AH-85
N82-33386
DAAB07-78-A-6606
N82-33378
DAAG46-80-C-0018
N82-32467
DAAK50-80-C-0011
N82-33379
DAAK51-81-C-0035
N82-32364
DAAK80-79-C-0270
N82-33386
DAKPA ORDER 3155
N82-33395
DB-AC02-76ER-03077
N82-34191
DB-AC02-80CS-50098
N82-32518
DJT-CG-39-81-C-80287
N82-34230
DJT-FA70WAI-175
N82-32336
DJT-FA74WA-J532
N82-33361
DJT-FA74WAI-461
N82-32330
DJT-FA79WA-4268
N82-33388
DTFA-81-Y-10574
N82-33167

DTFA01-80-C-10132
N82-32352
DTFA01-80-C-10133
N82-33151
DTFA01-81-C-10109
N82-33366
DTFA01-81-Y-10521
N82-32329
DTFA01-81-Y-10574
N82-33162
DTFA03-80-C-0080
N82-32351
FAA PROJ. 045-330-130
N82-33367
FAA PROJ. 181-350-320
N82-33360
FAA PROJ. 219-151-120
N82-32331
F04606-79-G-0082
N82-33384
F08635-78-C-0027
N82-33758
F08635-80-C-0122
N82-32512
F08635-80-C-0222
N82-33397
F08635-81-C-0019
N82-33552
F19628-80-C-0002
N82-32330
F19628-80-C-0042
N82-32336
F33615-76-C-1002
N82-32354
F33615-77-C-3096
N82-45538
F33615-78-C-2016
N82-33164
F33615-78-C-2024
N82-33551
F33615-78-C-3201
N82-46847
F33615-78-C-3609
N82-33401
F33615-79-C-5132
N82-32422
F33615-80-C-0513
N82-33359
F33615-80-D-4001
N82-33554
F33615-81-C-2056
N82-33651
F40600-80-C-0006
N82-33396
F49620-79-C-0038
N82-34340
N82-34341
M62269-80-C-0711
N82-32424
NAG1-81
N82-32382
NAG1-124
N82-32363
NAG1-250
N82-33374
NASA ORDER L-26971-B
N82-33373
NAS1-14472
N82-34191
NAS1-14741
N82-32346

NAS1-14742
N82-32349
N82-32380
N82-32381
N82-32858
NAS1-14743
N82-32319
NAS1-14744
N82-32348
N82-32377
NAS1-14890
N82-33735
NAS1-14946
N82-33148
NAS1-15080
N82-33338
N82-33339
NAS1-15148
N82-32421
NAS1-15325
N82-32349
N82-32380
N82-32381
NAS1-15327
N82-32315
NAS1-15506
N82-32379
NAS1-15588
N82-32378
NAS1-15927
N82-32344
N82-32345
NAS1-16772
N82-32375
NAS1-16934
N82-34191
NAS2-10148
N82-32899
NAS2-10765
N82-32368
N82-32369
NAS2-10975
N82-32374
NAS2-11058
N82-32341
NAS3-19755
N82-33392
NAS3-20629
N82-33393
NAS3-20646
N82-32383
N82-33394
NAS3-21719
N82-33347
NAS3-22346
N82-32370
NAS3-22347
N82-33375
NAS3-22525
N82-33391
NAS8-34337
N82-33698
NCC2-13
N82-32342
NGL-22-009-124
A82-45538
NR PROJ. 089-156
N82-32582
NSG-1308
N82-32312
NSG-1592
N82-33734
NSG-3283
N82-33390
N00014-80-C-0398
N82-32582
N00014-81-C-2476
N82-32386
N00019-77-A-0350
N82-32365
N00019-81-C-0424
N82-32573
N00024-76-C-5352
N82-33395
N00167-81-M-3207
N82-32357
N62269-81-C-0477
N82-33385
N68335-79-C-1084
N82-32425
W13550000
N82-33337
503-04-72
N82-33347
505-06-51
N82-33340
505-31-33
N82-34191
505-31-53-06
N82-33405
505-32-2
N82-33389
505-32-68
N82-33020
505-32-03-05
N82-33150
N82-34189
505-32-03-06
N82-34190
505-32-32
N82-32504
505-32-42
N82-32733
505-33-53-07
N82-33736
505-33-62
N82-33391
505-34-11
N82-32362
505-34-33-02
N82-32350
505-35-21
N82-33381
505-41-43-01
N82-33149
505-41-73-04
N82-32363
505-42-11
N82-32342
N82-32368
N82-32369
505-42-13-04
N82-33373
N82-33734
505-43-01
N82-34188

505-43-23-01
N82-32320
532-02-11
N82-32343
533-02-01
N82-33400
534-01-13-06
N82-33344
992-21-01
N82-33345

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